Environmental Impact Assessment (EIA) report quality for hazardous waste treatment facilities in South Africa

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ABSTRACT

Environmental Impact Assessment (EIA) is a tool used internationally for environmental protection and management to avoid or mitigate the potentially adverse or negative environmental impacts of developments. In South Africa, EIA is required for certain listed developments. EIA has been mandatory in South Africa since 1998, with several regulatory amendments, resulting in various EIA regulatory regimes. The National Environmental Management: Waste Act 59 of 2008 (NEMWA) provides for a licensing regime specific to such waste management activities. Several papers have been published relating to Environmental Impact Assessment Report (EIAR) quality review covering various sectors, such as mining, water management, biodiversity, explosives, housing development and transport. However, limited research has been conducted specifically on the quality of EIARs for hazardous waste management facilities in South Africa and none has determined EIAR quality across the two EIA regimes.

Therefore, the main aim of this research was to determine the quality of a sample of EIARs for hazardous waste treatment facilities in South Africa across the 2010 and 2014 EIA regimes.

An adapted Lee and Colley review package was used to review a sample of 14 EIARs. The results indicate that the quality of EIARs for hazardous waste treatment facilities in South Africa is generally satisfactory. Overall, 12 reports were graded satisfactory, and two reports were graded unsatisfactory. However, while the reports were satisfactory overall, there were also a few areas of weakness, areas of strength and a disturbing decline in report quality from 2010 to 2014 in some areas. It was therefore concluded that improvement in the quality of the reports is necessary for enhanced decision-making and best practice.

It is recommended that more research be conducted on the quality of EIARs for waste treatment facilities in South Africa. In particular, future researchers might assess a larger sample of EIARS and include those waste activities that were not covered in this study, such as waste disposal and recycling facilities.

Key words: Environmental Impact Assessment (EIA), EIA report quality, hazardous waste treatment facilities, EIA effectiveness, South Africa.

ABBREVIATIONS AND ACRONYMS

ACRONYM / ABBREVIATION	DESCRIPTION
BA	Basic Assessment
CA	Competent Authority
DFFE	Department of Forestry, Fisheries and the Environment
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPR	Environmental Management Programme Report
EPR	Extended Producer Responsibility
GNR	Government Notice Regulation
I&APs	Interested and Affected Parties
NEMA	National Environmental Management Act
NEMWA	National Environmental Management: Waste Act
NWMS	National Waste Management Strategy
RA	Review Area
USA	United State of America
WML	Waste Management Licence

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Waste is a significant environmental problem internationally. Its impact is influenced by the increase in population, economic development, urbanisation and mismanagement, and the corresponding increase in the amounts of more waste being generated (Wilson & Velis, 2015; South Africa, 2017; Zorpas, 2020). According to Zorpas (2020) it is projected that by 2030 approximately 2.59 billion tons of waste will be generated per year and that the amounts will continue to increase.

In particular, about 400 million tons of hazardous waste is generated internationally on a yearly basis. The most significant sources of hazardous contaminants are from industrial activities. Hazardous waste is seen to have detrimental impacts on human health and the environment (Akpan & Olukanni, 2020). Therefore, hazardous waste streams require specialised treatment facilities and focused management actions to ensure environmental protection.

The environmental impacts of waste and pollution can be significant, and it is therefore vital to manage it appropriately and, thereby minimise its effects. Various tools, including Environmental Assessments, norms and standards, Extended Producer Responsibility, Environmental Management Systems and Environmental Monitoring and Audits are used to ensure that waste is managed in an effective manner and does not degrade the environment.

In South Africa, various tools are identified in Chapter 5 of the National Environmental Management Act (NEMA) 107 of 1998 including Environmental Impact Assessments (EIAs), Environmental Management Frameworks, Strategic Environmental Assessments, Environmental Management Programmes (EMPs), environmental risk assessments, environmental feasibility assessments, norms and standards, spatial development instruments or tools and integrated planning (South Africa, 2014b). These instruments are all guided by policies and legislations. Of these tools, the EIA is widely utilised and therefore the dissertation focuses on the tool.

An EIA is a process of identifying, predicting and assessing potential environmental impacts, both positive and negative for a proposed development and considering mitigation measures to reduce the identified significant impacts. It is used to inform decision - makers on the risks or impacts associated with a specific proposed development (South Africa, 2004a; South Africa, 2014b). Thus, it is an important environmental management tool to ensure that there is environmental protection and sustainable development.

Globally, EIA has evolved over the past three decades and is regarded as one of the most effective and broadly used tools for implementing environmental policies worldwide. As such, it is globally recognised as a key tool for environmental management. As EIA evolved, it also changed, influenced by factors such as the specific needs of decision - makers, various decision-making processes and the practical experiences acquired as it was applied (Morgan, 2012). Even though EIA has been adapted to particular situations and needs, there is a broad consensus concerning its basic purposes and core elements (Jay *et al*., 2007; Retief, 2010).

1.2 EIA in South Africa

In South Africa, the National Environmental Management Waste Act (NEMWA) 59 of 2008 provides for an EIA licensing regime specific to waste management activities. Hazardous treatment facilities which trigger certain listed activities as per the waste listed activities, require an EIA for licensing purposes. The NEMA EIA Regulations and processes is followed for waste listed activities. South Africa has a long history of EIAs, which were conducted voluntarily since the early 1970s (Sowman *et al*., 1995). It was only in September 1997 that South Africa began to enforce EIA, when the government gazetted EIA regulations (South Africa, 2004a). However, it became mandatory only in 1998, upon the promulgation of the EIA regulations in terms of the Environment Conservation Act (ECA) 73 of 1989 (South Africa, 1989). These regulations included a list of activities for which EIA was mandatory. This regime was referred to as the 'ECA regime'. Since then, there have been revisions to the EIA regulations, including the 2006, 2010, 2014 and the 2017 EIA regimes in terms of National Environmental Management Act (South Africa, 2006; South Africa, 2010; South Africa, 2014a, South Africa, 2017). NEMA also enables the framework for co-operative environmental governance in South Africa and encourages the use of management tools and environmental assessment to ensure the integration of environmental management activities (South Africa, 2004a).

1.3 EIAR quality

The strengths and weaknesses of EIA have become clear over the years. Its effectiveness has been a concern in the EIA practice and research community (Barker & Wood, 1999; Sandham *et al*., 2013a; Chanchitpricha & Bond, 2013; Loomis & Dziedzic, 2018; Bond *et al*., 2022). One of the factors that determines its effectiveness is the quality of the Environmental Impact Assessment Report (EIAR). The effective functioning of the EIA system for waste management is dependent on the quality of the reports which provide the basis for decision - making (Sandham & Pretorius, 2008; Sandham *et al*., 2013b; Sandham *et al.,* 2020). EIARs are used by the competent authorities to make the final decision on the specific application. Widespread research has been published in both the developed and developing countries on the quality of EIARs (Barker & Wood, 1999; Lee &

Colley, 1999; Sandham *et al*., 2008a; Sandham *et al*., 2008b; Peterson, 2010; Talime, 2011; Sandham *et al.,* 2013a; Sandham *et al*., 2020).

1.4 Research problem statement

Several research papers have been published in South Africa regarding the quality to EIA reports. These cover several sectors such as mining, water management, biodiversity, explosives, housing development, transport (Sandham & Pretorius, 2008; Sandham *et al*., 2008a; Sandham *et al*., 2008b; Mbhele, 2009; Van Heerden, 2010; Hallatt *et al*., 2015; Sandham *et al*., 2013b; Sebetlele, 2018; Sandham *et al*., 2020; Botha, 2022). However, limited research has been conducted and published on the quality of EIARs for hazardous waste treatment facilities in South Africa in particular. Research was conducted on the quality of EIARs associated with hazardous waste management activities in South Africa in 2014 and 2019 (Thorpe, 2014; Ceronio, 2019). Thorpe (2014) examined the quality of hazardous waste related Scoping reports and not the full EIARs under the 2010 regime and Ceronio (2019) focused only on Gauteng with a limited sample and assessed only the 2010 regime. Thus, no researcher to date has evaluated the progress made since the 2010 regime. This constitutes a gap in the literature. Therefore, determining the quality of a sample of EIARs for hazardous waste treatment facilities in South Africa across the two regimes is the main aim of the current research.

The main aim and the objectives of the study are discussed below.

1.5 Research aims and objectives

In order to address the problem noted above, the following main research question was formulated:

What is the quality of EIARs for hazardous waste treatment facilities in South Africa?

The broad aim is to determine the quality of EIARs for a sample of hazardous waste treatment facilities in South Africa.

Inorder to achieve the broad aim, the following objectives were formulated:

1. To review the quality of selected EIARs for hazardous waste treatment facilities for the NEMA 2010 and 2014 EIA regimes using the adapted Lee and Colley review package.
2. To analyse, compare and interpret the results that were obtained from the review.
3. To identify the strengths and weaknesses of the EIA reports.

1.6 Scope of the research

This research focused on hazardous waste treatment facilities which triggered a waste management activity (ies) and required an EIA process to obtain a waste management licence. The research focused on reports submitted in terms of the NEMA 2010 and 2014, as amended South African EIA Regulations. The research considered hazardous waste treatment facilities in South Africa. Reports from both regimes were selected to ensure representation of both regimes. More details are explained in the methodology chapter.

1.7 Assumptions and limitations

Due to the nature of the study, the research only focused on the quality of EIARs for hazardous waste treatment facilities in South Africa and not all waste facilities. The research only focused on the 2010 and 2014, as amended South African NEMA EIA Regulations and only reviewed a limited number of 14 EIARs.

1.8 Format and structure of the dissertation

The dissertation is presented in five chapters. Chapter 1 is an introductory chapter which includes the problem statement, the research question and the aim and objectives. Chapter 2 comprises a critical review of the existing research literature. Chapter 3 is an outline of the methodology utilised, including how the data were collected and the method used to determine the quality of EIA for hazardous waste treatment facilities in South Africa. Chapter 4 is an analysis of the data collected and, lastly, Chapter 5 contains the conclusion and recommendations based on the results.

CHAPTER 2: LITERATURE REVIEW

This chapter comprises a review of the literature related to hazardous waste management and EIAR quality. First, the international and South Africa literature on waste management is reviewed. The development of EIA internationally and, in more detail, its development and practice in South Africa is then dealt with. Lastly, the various review packages used internationally and the findings of the relevant studies in South Africa are described.

2.1 Waste Management

Approximately 400 tons of hazardous waste is generated internationally, and by 2030 it is predicted that approximately 2.59 billion tons would be generated (Akpan & Olukani, 2020). Waste can have significant negative impacts on both the environment and the health of human beings. Effective waste management is necessary to minimise the effects of the rising waste generation, which is a global problem.

2.2 Waste Management in South Africa

In South Africa, the Constitution provides for environmental rights. To give effect to these environmental rights, the National Environmental Management Act (NEMA) (Act no.73 of 1998) was promulgated. In terms of section 24 of the Constitution (1996:1251):

"*Everyone has the right –*

> *a) To an environment that is not harmful to their health or wellbeing; and*
>
> *b) To have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that:*
>
> *(i) prevent pollution and ecological degradation;*
>
> *(ii) promote conservation; and*
>
> *(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

Waste Management is governed by the NEMWA (Act No. 59 of 2008). To give effect to this Act, the Department of Forestry, Fisheries and the Environment (DFFE) developed the National Waste Management Strategy (NWMS) (South Africa, 2020). The key focus of the NWMS is to divert waste from landfills and to encourage the beneficial use of waste as part of a circular economy. According to the Ellen MacArthur Foundation, a circular economy is " *a system solution framework that tackles global challenges like climate change, biodiversity loss, waste and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circular products and materials*

(at their highest value), and regenerate nature". A circular economy requires an understanding and application of the waste hierarchy and is related to green economy and other Extended Producer Responsibility measures (South Africa, 2020. In a circular economy, when waste cannot be avoided, it is reused, recycled and recovered through the economic cycle to minimise the waste generated. The diagram below is an illustration of a circular economy.

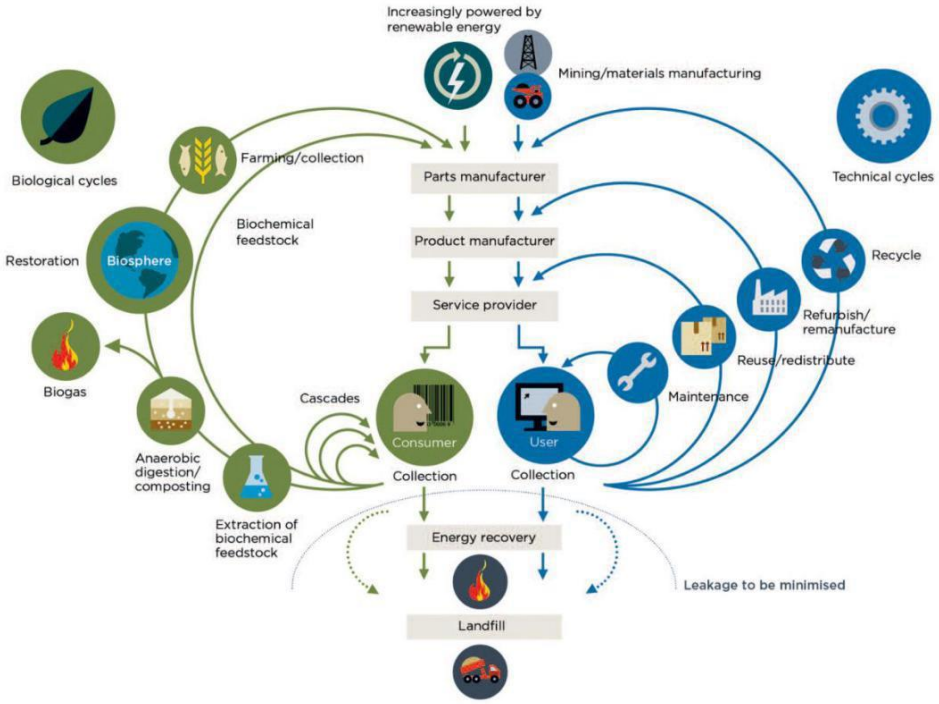

Figure 2-1: Butterfly diagram illustrating a circular economy (Ellen MacArthur Foundation, 2019)

Even though the waste sector in South Africa focus is the transition of the linear to a circular economy, the reuse, recycling and recovery activities still require other measures such as the licensing process to manage waste and its associated activities that should be practised by the different spheres of government (South Africa, 2020).

The waste hierarchy indicated in Figure 2 below comprises three key principles of the 2020 NWMS.

"Waste minimisation" means that waste generation should be reduced to a bare minimum. When it cannot be minimised, its noxiousness should be curtailed before disposal. "Waste prevention" is avoiding waste generation and its noxiousness, whereas "waste as a resource" is when waste generation cannot be avoided. In such instances, beneficial use should be found for it through "*reuse, recycling, treatment and recovery*" to reduce the amount and noxiousness of waste before disposal (South Africa, 2020). Figure 2 below is an illustration of the waste hierarchy.

Figure 2-2: Waste Management Hierarchy (South Africa, 2020:28)

NEMWA makes a distinction between two types of waste, namely general and hazardous waste. The distinction is based on the risk posed by the waste. General waste governance is a function of the provincial authority, and it can be disposed of in municipal disposal sites. Hazardous waste is a function of the national authority and requires stricter controls. According to the Waste Classification and Management Regulations (South Africa, 2013), waste generators (excluding domestic waste, which is collected by the local municipality) must classify the waste according to the South African National Standard (South Africa, 2013b). According to South Africa (2008) hazardous waste is "*any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in Schedule 3"* (South Africa, 2008:12)

2.3 EIA Internationally

Internationally, EIA can be traced back to 1969 in the United States of America (USA) when the National Environmental Policy Act was promulgated. It was required that the Federal development projects assess any potential environmental effects prior to commencement of projects (Retief, 2010 Morgan, 2012; Kidd *et al*., 2018). This constituted an attempt to protect the environment in response to a rapid loss of natural resources, which gave rise to concerns about *pollution, quality of life and environmental stress*. The projects were perceived to be disturbing the environmental

resources, raw material and people. EIA has been acknowledged as one of the most successful policy interventions of the past decades. Since its origin in the USA, EIA has been broadly adopted. Most countries have acknowledged the need and implemented some form of EIA into their legislation relating to planning and environmental decision- making (Retief, 2010 Morgan, 2012).

2.4 EIA – South African context

EIAs have been conducted in South Africa since the early 1970s (Sowman *et al*., 1995) and became mandatory in 1998, with the promulgation of the ECA 73 of 1989 (South Africa, 1989). In 1998, the ECA was partially repealed by the publication of the National Environmental Management Act, Act No. 107 of 1998 (NEMA) including sections 21, 22 and 26, and the regulations promulgated in 1997, remained in force until 2006. NEMA made the framework for co-operative environmental governance in South Africa available and encouraged the use of environmental assessment and other management tools to ensure the integration of the environmental management of activities (South Africa, 2004a).

Between September 1997 and March 2006, approximately 43, 423 EIA applications were submitted in South Africa (Retief *et al*., 2011). After a lengthy revision process EIA came into effect under NEMA through the promulgation of the 2006 NEMA regulations and the repeal of the 1997 regulations. This was then referred to as the NEMA regime (South Africa, 2006). The intention of the NEMA regime was to reduce the high number of EIA applications received between 1997 and 2006 by at least 20% and to ensure that limited resources and time were dedicated to improving the EIA system, in accordance with international best practice, while not disregarding the environment or failing to consider the preventative principles contained in the NEMA (Retief *et al*., 2011).

The revised 2006 regulations included Government Notice Regulation (GNR) 385, which stipulated the process to be followed, GNR 386 and GNR 387 (see the lists in Table 2-1), which were a modified list of the activities covered by the Regulations (South Africa, 2006). The EIA consists of two processes, namely the Basic Assessment (BA), and Scoping and a full EIA. Each process is triggered by the listed activities and their thresholds. The BA is conducted for proposed developments with low thresholds and where the development is considered to have potentially fewer significant impacts. Scoping and full EIAs must be conducted for developments that are believed to potentially have greater significant impacts and which have a wider scope.

The list was revised in 2010 in terms of regulations contained in GN R543, GN R544, GN R545 and GN R546, and a timeframe was attached to the process (South Africa, 2010). The regulations were revised again in 2014 by the promulgation of GN R983, GN R985 and GN R986 (South Africa, 2014a). The 2014 regulations contained stricter timeframes, including giving the Competent

Authority (CA) timeframes in which to comment and make decisions on reports. In 2017, the regulations were again amended and included GNR 326, GNR 327, GNR 325 and GNR 324 (South Africa, 2017a). The table below gives a description of the Government Notice Regulations.

Table 2-1: Government Notices Regulations and descriptions

GOVERNMENT NOTICE REGULATION (GNR)	DESCRIPTION
385	National Environmental Management Act: Environmental Impact Assessment Regulations, 2006
386	List of activities and competent authorities identified in terms of section 24 and 24Dof the NEMA, 1998.
387	List of activities and competent authorities identified in terms of section 24 and 24D of the NEMA, 1998.
543	National Environmental Management Act: Environmental Impact Assessment Regulations, 2010
544	Listing Notice 1: List of activities and competent authorities identified in terms of section 24(2) and 24(D)
545	Listing Notice 2: List of activities and competent authorities identified in terms of section 24(2) and 24(D)
546	Listing Notice 3: List of activities and competent authorities identified in terms of section 24(2) and 24(D)
547	Environmental Management Framework Regulations, 2010
982	National Environmental Management Act: Environmental Impact Assessment Regulations, 2014
983	Listing notice1: List of activities and competent authorities identified I terms of section 24(2) and 24(D)
984	Listing notice 2: List of activities and competent authorities identified I terms of section 24(2) and 24(D)
985	Listing notice 3: List of activities and competent authorities identified I terms of section 24(2) and 24(D)
326	National Environmental Management Act: Amendments to the Environmental Impact Assessment Regulations, 2014
327	Listing notice 1: amendment of the list of activities
325	Listing notice 2: amendment of the list of activities
324	Listing notice 3: amendment of the list of activities

The regulations require an independent Environmental Assessment Practitioner (EAP) to be appointed by the developer or the applicant, to conduct an EIA, including a comprehensive and transparent public participation process involving all potential Interested & Affected Parties (I&APs) and to submit an EIAR to the relevant CA for decision-making (South Africa, 2014a). According to Sandham *et al*. (2020) sound environmental decision making relies on the quality of the content of the EIAR.

2.5 Waste Management and EIA in South Africa

The NEMWA 59 of 2008, as one of the Specific Environmental Management Acts read in conjunction with GN R921, is a regulation for waste activities which also makes provision for EIA. It is a requirement that a waste management licence be obtained prior to the commencement of any waste activities listed in the regulations (South Africa, 2013a). The NEMWA (59 of 2008) provides for a licensing regime specific to waste management activities. The licensing regime replaces the previous system of permits issued in terms of the repealed section 20 of the Environment Conservation Act, (73 of 1989). The waste activities list provides for activities under category A, B and C. Category A activities are most general waste activities with low thresholds. The impacts are well understood and therefore require only a BA. Category B activities have high thresholds, and the potential impacts are more likely to be significant and broader in scope. Therefore, they require a full EIA. Activities listed under Category C (South Africa, 2017b) do not require an EIA, but do require registration under the relevant norms and standards.

The national, provincial and local spheres of government are legally responsible for waste management in South Africa. The NEMWA (59 of 2008) specifies differing mandatory provisions for all spheres of government in terms of which the Minister of the DFFE is the licensing authority for hazardous waste activities. The DFFE is furthermore, among others, responsible for, promoting and ensuring the implementation of the national waste management strategy and national norms and standards. The DFFE is the leading agent for waste management related functions, including the development of policies, strategies and legislation.

2.6 Procedural steps in EIA

An EIA is performed in several steps. Most of the systems consist of the following generic components, namely: "*screening, scoping, public participation, consideration of alternatives and mitigation measures, assessment of impact significance, reporting, review, authorisation and post-decision monitoring"* (Retief *et al*, 2011:155).

The figure below illustrates the EIA procedural steps.

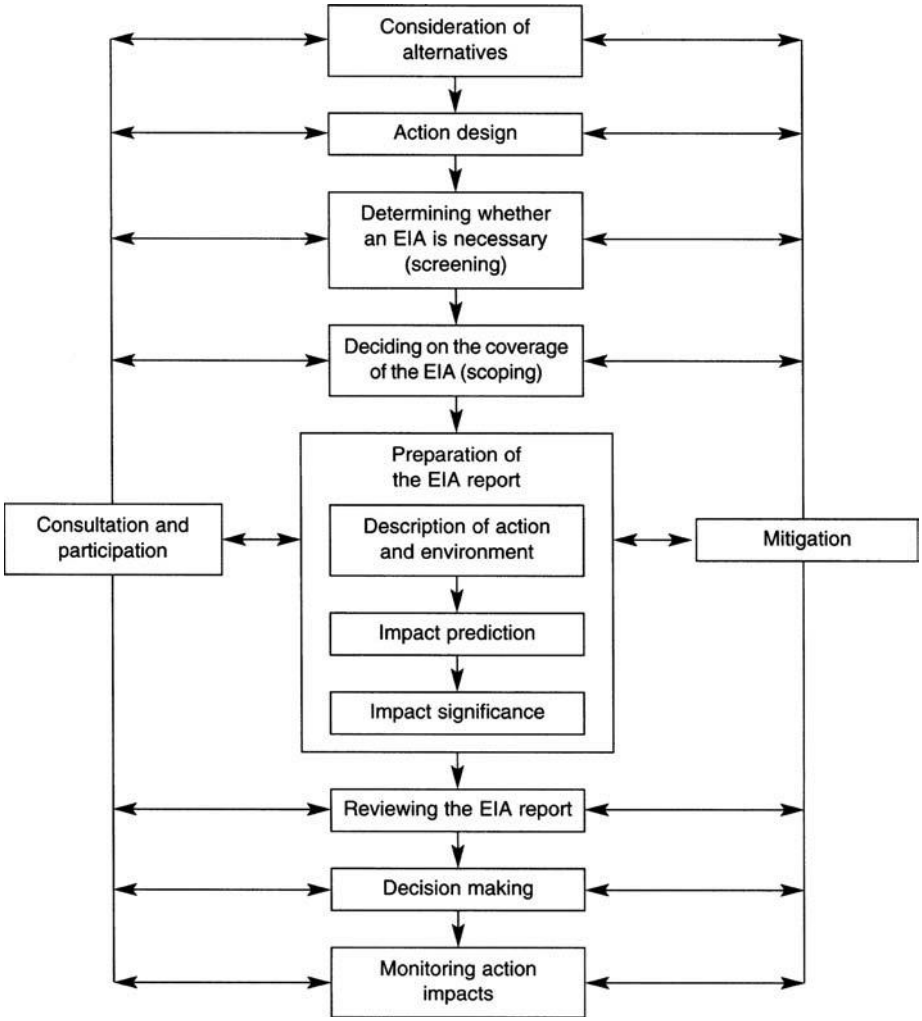

Figure 2-3: Generic EIA process (Retief *et al*., 2011:155)

2.6.1 Screening

It is globally acknowledged that an effective screening tool is a crucial stage of a well-functioning EIA system (Retief *et al*., 2011; Kidd *et al*., 2018; Sandham *et al*., 2022). Screening is completed in the early stage of an EIA process, where it is determined whether an EIA is required for a specific development. If required, the extent to which it will be required is also determined. A BA is conducted for proposed developments with few potentially significant impacts and a BA Report is submitted for such developments. Scoping and full EIA is followed for developments with significant potential impacts and an EIAR is submitted for such developments. The requirements for screening are specified in the applicable EIA legislation which indicates the activities that require an EIA to be conducted and provides a clear indication of the issues to be considered when making decisions (South Africa, 2004b). A report produced by the national web-based environmental screening tool must be submitted together with the EIA application and reports in accordance with section 24 (5) (h) of the NEMA (Act No 107 of 1998) and regulation 16 (1) (b) (v) of the EIA regulations, 2014 as amended (South Africa, 2014a; Sandham *et al.,* 2022).

2.6.2 Scoping

Once it is determined that an EIA is required, scoping follows. Among the wide range of possible impacts, scoping facilitated the identification of only the most crucial and significant issues to be addressed by an EIA and includes both the positive and negative aspects of a proposed development. Scoping is conducted for both a BA and full EIA processes. However, in South Africa, only the Scoping and full EIA process include the scoping step in the process diagram (Glasson *et al*., 2012 Aucamp, 2009). Scoping ensures that there is a sound relation between the issues identified and the method of assessment. The plan of study, which is part of the scoping process, gives direction to the final assessment (South Africa, 2004c).

2.6.3 Public Participation

According to Aucamp (2009), public participation is the involvement of all the I&APs of the proposed project. Relevant I&APs and stakeholders are identified for each development and their consultation and participation in the process ensures that their views are adequately considered in the decision making (South Africa, 2004d; Glasson *et al*., 2012.

2.6.4 Consideration of alternatives

The main aim of considering alternatives is to ensure that the proponent has taken into consideration other feasible approaches and found the most effective method to meet the proposal's need and desirability, either through "enhancing *the environmental benefits or through reducing or avoiding the potential significant negative impact"* (South Africa, 2004f). The main criterion for alternatives is that they should be *"practicable", "feasible", "relevant", "reasonable", "affordable" and "viable"* and should be considered early in the project's life cycle (Glasson *et al*., 2012 South Africa,2004f; Aucamp, 2009).

2.6.5 Assessment of impact significance

The impacts that have been identified need to be assessed to determine their significance. The objective of assessing the significance of the impact is to identify the severity of the impacts of the proposed development on the environment in terms of both the negative and positive impacts. The significance of an impact is determined on the basis of various criteria, including the *extent, duration, intensity or severity of the impact, status, reversibility, degree of certainty and migratory potential*. The significance ratings are done before and after consideration of mitigation measures (South Africa, 2004e).

2.6.6 Consideration of mitigation measures

Consideration of mitigation measures involves the identification of other possible ways of avoiding negative impacts. Where negative impacts cannot be avoided, they should be minimised. Positive impacts can be explored further to enhance the benefits.

2.6.7 Reporting

A report containing the findings of the impact assessment and mitigation measures is compiled and submitted. Compiling and publishing the EIAR is one of the important steps in the EIA process because the final report is used by the competent authorities for decision-making (Mounir, 2015. The report should include all the necessary environmental information related to the project for decision- making (Jalava et al., 2010).

2.6.8 Review

The EIAR is reviewed by the competent authorities for decision-making. The review ensures that the report meets the minimum standards according to a country's requirements. In South Africa, the report must meet the minimum requirements stipulated in the EIA Regulations. Generic review principles include *consistency, logic, sufficiency, efficiency and assumption* (South Africa, 2004g; South Africa, 2014a).

2.6.9 Decision

The CA makes a decision based on the review of the EIAR. The decision taken is either to authorise or refuse the proposed development. The decision is referred to as an Environmental Authorisation (EA) or a Waste Management Licence (WML) for waste activities. The authorisation or licence stipulates conditions under which the developers are permitted to proceed with the development. The decision conditions become part of the management plan for the project.

2.6.10 Post decision monitoring

The impacts of the development and the effectiveness of the mitigation measures committed to during the EIA process are monitored to ensure that the conditions established are met.

2.7The effectiveness of EIA

The value added by EIA to decision-making for developments has been an area of debate, especially in developing countries such as South Africa, where there has been an impression that EIA constitute an obstructive process that delays development (Retief *et al*., 2011; Kidd *et al*., 2018; Sandham *et al*., 2022). EIA effectiveness is a question of whether the EIA process achieves

its purpose of providing information for decision makers on environmental consequences of proposed developments (Jay *et al*., 2007; Loomis, 2018). The process depends on the information presented in the EIAR, therefore, an important component of effectiveness is the quality of the EIAR prepared by the proponent. The quality of the review is also one of the control functions that contributes to its effectiveness (Morrison – Saunders *et al*., 2001; Sandham and Pretorius, 2008; Sandham, 2013a; Mounir, 2015 Bond *et al*., 2022).

2.8 EIA Review Packages

Several methods of evaluating the quality of EIARs have been developed and used globally. The matrix method is used in some countries, such as Taiwan, however the method which is most commonly used is a review package or a checklist (Sandham & Pretorius, 2008; Lee and Colley, 1999). Several review checklists have been adopted and adapted globally (South Africa, 2004g).

2.8.1 The European Commission Guideline

The European Commission Guideline (ECG) is a checklist containing 143 review questions divided into seven sections, which might include subsections (Peterson, 2010). The reviewer can select "yes" or "no" as an answer to each question. However, a five-grade system is also provided. The ECG is similar to the Lee and Colley review package because it uses a scale of grades A – E which indicate the level of quality (Ceronio, 2019). Symbols A – C indicate "adequate with sufficient information for decision-making". Symbols D and E are regarded as poor quality information and unsatisfactory for decision-making (Peterson, 2010).

2.8.2 The Oxford Brookes Review Package

Glasson developed the Oxford Brookes Review Package also referred to as the "Impact Assessment Unit" (IAU) review package (Glasson *et al*., 2012. This package was developed to investigate the changing quality of Environmental Impact Statements (EIS) in the United Kingdom (UK). The review package is seen to be similar to both the Lee and Colley review package and the ECG because it uses a grading system, although it has only three levels. The review package has 92 criteria although not all of them apply to all projects (Glasson *et al*., 2012).

2.8.3 The Lee and Colley review package

Lee and Colley developed a review package in 1989 (Lee and Colley, 1999) for the purpose of evaluating the quality of environmental statements submitted in response to a directive mandating environmental assessments in UK planning regulations. The Lee and Colley review package is a four-tier package, which has been used to perform EIA reviews and has been adapted to the EIA procedures of numerous nations. Although many tools were developed by various experts, the Lee

and Colley package is familiar to many EIA professionals and mostly used due to its quality and relevance (Lee *et al*., 1999; Mounir, 2014). The Lee and Colley review package is used for this study and explained in more detail in Chapter 3.

2.9 EIAR quality Internationally

A number of papers on the quality of EIAR have been published internationally. For example, Barker and Wood (1999) reviewed the quality of 112 EIARs – eight each from Belgium, Denmark, Greece, Ireland, and Portugal and 24 reports each from Germany, Spain, and the UK. The researchers applied the Lee and Colley review package. In the Republic of Niger, the quality of a sample of 15 EIARs from 2008 to 2012 were evaluated by applying the Lee and Colley review package (Mounir, 2015).

2.10 EIAR quality in South Africa

In South Africa, various studies have been conducted on the quality of EIAR in several environmental areas (Sandham & Pretorius, 2008; Sandham *et al*., 2008a; Sandham *et al*., 2008b; Mbhele, 2009; Van Heerden, 2010; Sandham *et al*., 2013; Thorpe, 2014; Hallatt *et al*., 2015; Sebetlele, 2018; Ceronio, 2019; Sandham *et al*., 2020; Botha, 2022; Malepe *et al*., 2022). Some of these studies are briefly discussed below.

EIAR quality in the North - West province

The quality of EIARs in the North – West province was determined by Sandham and Pretorius (2008) by applying the Lee and Colley review package to a sample of 28 EIARs from the North - West province looking at four sectors, namely electricity and fuel, water supply, sewage and waste, land use change and telecommunication. The results showed that the quality was satisfactory. Overall, 86% were graded as satisfactory. Description of the project and environment, and communication of results performed well while the identification and evaluation of key impacts and consideration of alternatives and mitigation performed poorly.

EIAR quality of projects with the potential of affecting wetlands

Sandham *et al*. (2008b) reviewed the quality of EIARs for projects with the potential of affecting wetlands in South Africa. The study applied the Lee and Colley review package to review a sample of four EIARs for large projects. The results indicated that the quality was satisfactory. All four reports were graded as satisfactory, three reports were graded B (generally satisfactory) and one report was graded C (just satisfactory). The results also showed that the four Review Areas were satisfactory, with the description of the development and the environment and communication of

results performing well, and the consideration of alternatives and mitigation of impacts and the identification and evaluation of key impacts performing weaker.

EIAR quality for mining

Sandham *et al*. (2008a) evaluated the quality of EIARs for the mining industry in South Africa by applying the Lee and Colley review package to a sample of 20 EIARs. The results indicated that the quality was generally satisfactory, with 85% of the reports being graded A-C (satisfactory), 40% graded B (generally satisfactory) and 45% graded C (just satisfactory). Two reports were graded D (just unsatisfactory), one report was graded E (poor attempt) and none of the reports were graded F (not attempted). The description of the development and the environment and communication of results performed well, with higher grades, whereas the identification and evaluation of key impacts and alternatives and mitigation measures generated with lower grades.

EIA report quality for residential developments

The quality of EIARs for housing developments in the Nkangala district of the Mpumalanga province in South Africa was determined by Mbhele (2009). The study applied a modified Lee and Colley review package to review a sample of 15 EIARs. The results demonstrated that the quality was satisfactory. Overall, 11 reports (73%) were graded A-C (satisfactory), of which one report (7%) was graded A (well performed), four reports (27%) were graded B (satisfactory) and six reports (40%) were graded C (just satisfactory). Four reports (27%) were graded D (just unsatisfactory). None of the reports were graded E (poor attempt) or F (not attempted). The results further showed that the description of the development and the environment performed well, followed by the identification and evaluation of key impacts and lastly, communication and results. Consideration of alternatives and mitigation performed poorly.

Botha (2022) reviewed the EIAR quality of middle to high income residential developments in South Africa by applying an adapted Lee and Colley review package to review a sample of eight EIARs. The quality of EIARs was found to be generally satisfactory. Six reports were graded B (generally satisfactory), one report graded C (just satisfactory) and one graded D (just unsatisfactory). None of the reports were graded A (well done).

EIAR quality before and after 2006 in South Africa

The quality of EIARs before and after 2006 was evaluated by Van Heerden (2010). The researcher adapted and applied the Lee and Colley review package to review a sample of 26 EIARs. The

results showed that the quality was generally satisfactory in both periods, but there was no significant improvement from the 1997 to the 2006 regimes.

EIAR quality for explosive industry projects in South Africa

Sandham *et al*. (2013b) reviewed the quality of EIARs for four large explosive projects in South Africa, again applying the Lee and Colley review package to review. They found that the quality was generally satisfactory. Overall, three reports were graded B (satisfactory) and one report was graded C (just satisfactory). Communication of results performed well, while the description of the development and the environment, identification and evaluation of key impacts and the consideration of alternatives and mitigation measures performed weaker.

EIAR quality for Biodiversity

Hallatt *et al*. (2015) determined the quality of biodiversity inputs in EIARs in areas with high biodiversity value from the Cape Floristic region in South Africa. The research applied an adapted Lee and Colley review package to review a sample of 26 Biodiversity Impact Assessment (BIA) reports. The results showed that 73% was graded A-C (satisfactory) of which 27% were graded A-B (well done), 27% were graded D-F (not satisfactory) and none of the reports were graded as poorly done.

EIAR quality for railway projects

Sebetlele (2018) determined the quality of EIARs in South Africa prior to and post 2014. He applied an adapted Lee and Colley review package to review a sample of 12 EIARs. The sample covered three regimes (2006, 2010 and 2014). The results showed that the quality of EIARs was satisfactory. All (100%) the EIARs were graded A-C (satisfactory) and the quality improved over time, from the 2006 to 2010 and 2014 regimes. The description of the development and the environment and communication of the results performed well for the 2006 and 2010 regime.

EIAR quality in South African national parks

Sandham *et al*. (2020) reviewed EIA quality in South African national parks, applying an adapted Lee and Colley review package for a sample of 24 EIARs within ten national parks under three EIA regimes (ECA 1997, NEMA 2006/10 and NEMA 2014/17). This was the first study in which EIARQ was investigated over all the EIA regimes. The results showed that the EIARs were of good quality, but with weaknesses in the waste, and significance and mitigation review areas. Overall, 92% (22 reports) were graded A-C (satisfactory), of which six reports (25%) were graded A (well

performed), 58% (14 reports) were graded as B (generally satisfactory) and two reports (8%) were graded C (just satisfactory). Another two reports (8%) were graded D (just unsatisfactory) and none of the reports were graded E (unsatisfactory) or F (very unsatisfactory). Presentation and communication performed well followed by the description of the project and environment and alternatives and mitigation. Impact identification and evaluation performed the weakest.

Malepe *et al*., (2022) evaluated the quality of EIARs for tourism developments in protected areas. The study reviewed eight approved EIARs by applying the adapted Lee and Colley review package. The Sandham et al. (2013) version was applied to fit the South African EIA system in accordance with the 2006 and 2010 EIA Regulations. However further adjustments were made to include additional sub-categories to address the procedural requirements of the revised 2014 and 2017 EIA Regulations. They found the quality of the EIARs generally satisfactory. One report was graded A (no tasks left incomplete) four reports were graded B (generally satisfactory and complete, only minor omissions and inadequacies) three reports were graded C (just satisfactory). None of the reports were considered to be unsatisfactory (D), poorly attempted (E) or not attempted (F).

Report quality in the hazardous waste management sector

Only two studies could be found on the report quality of hazardous waste associated activities and are discussed as follows.

Thorpe (2014) evaluated the quality of EIA scoping reports associated with hazardous waste management activities in South Africa. The research applied an adapted Lee and Colley review package to review a sample of 20 Scoping reports. The adapted version by Sandham and Pretorius (2008) was modified to include provisions for the scoping procedure and waste management provisions. The results indicated that the quality was satisfactory, with 75% of the reports being graded A-C (satisfactory), of which 40% were graded A-B (well done), 25% unsatisfactory and 10% poorly attempted. Description of the development and the environment and communication of results performed well, with the identification and evaluation of key impacts and legislative, guideline and policy review being the worst performed Review Areas.

Ceronio (2019) reviewed the quality of EIARs in the hazardous waste management sector in the Gauteng province. The researcher applied the Lee and Colley review package as well as the EIA Quality Index to review five EIARs (full EIA). The adapted version by Sandham and Pretorius (2008) was applied and further modified to include provisions associated with hazardous waste management regulations. The results showed that the quality of the EIARs were generally satisfactory. Overall, 60% were graded as excellent (A), 20% were graded B (generally

satisfactory) and 20% were graded C (just satisfactory). The consideration of alternative and mitigation performed poorly.

The limitations of these studies are that Thorpe (2014) dealt only with scoping reports only and not the full EIARs because he was doing a rapid review. Moreover, he focused only on the 2010 NEMA regime. Ceronio (2019), on the other hand, focused only on the 2010 NEMA regime and utilized a limited sample of only five EIARs.

2.10.1 Discussion of EIAR quality in South Africa

It is evident from the previous studies reviewed above that the adapted Lee and Colley review package is well known and widely used for quality review of EIARs. The findings from these studies indicate that the quality of EIARs in South Africa is largely satisfactory. The findings further indicate that the description of the development and the environment and communication of the results, which are the descriptive tasks, are performed better than the more technical and analytical tasks, such as the identification and evaluation of key impacts and consideration of alternatives and mitigation measures (Sandham & Pretorius, 2008; Sandham *et al*., 2008a; Sandham *et al*., 2008b; Mbhele, 2009; Van Heerden, 2010; Sandham *et al*., 2013; Thorpe, 2014; Hallatt *et al*., 2015; Sebetlele, 2018; Ceronio, 2019; Sandham *et al*., 2020; Botha, 2022; Malepe, 2022).

2.11 Chapter summary

The purpose of this chapter was to review the existing international and local literature on EIA, the EIA procedural steps, its effectiveness and the quality of EIARs in South Africa. To determine the quality of EIARs for hazardous waste treatment facilities in South Africa, the methodology, including the adapted Lee and Colley review package is described in the following chapter.

CHAPTER 3: METHODOLOGY

In this chapter, the methodology used for the research is outlined. First, the study area is described and illustrated with a map (Figure 4). This is followed by an explanation of how the data were collected, including a list of the projects selected, a description of the research method and a justification of the method chosen, and lastly description of the data analysis.

3.1 Study area

The quality of a sample of EIARs was investigated for hazardous waste treatment facilities in South Africa. According to the Department of Forestry, Fisheries and the Environment (DFFE) (2020:12), South Africa generated approximately 67 million tonnes of hazardous waste in 2017, of which 93% was landfilled and the remainder is unaccounted for. In order to reduce the large percentage being landfilled, the waste hierarchy is strongly recommended, whereby disposal of waste must be regarded as the last option. Therefore, the other options, such as treatment of waste, are encouraged. EIAs are required to ensure that significant environmental impacts are avoided or minimised and that applies to waste management as well.

The map below (Figure 4) shows the location of the projects selected. The lighter green shows the provinces (Northern Cape and Free State), which were not sampled due to reports not being available.

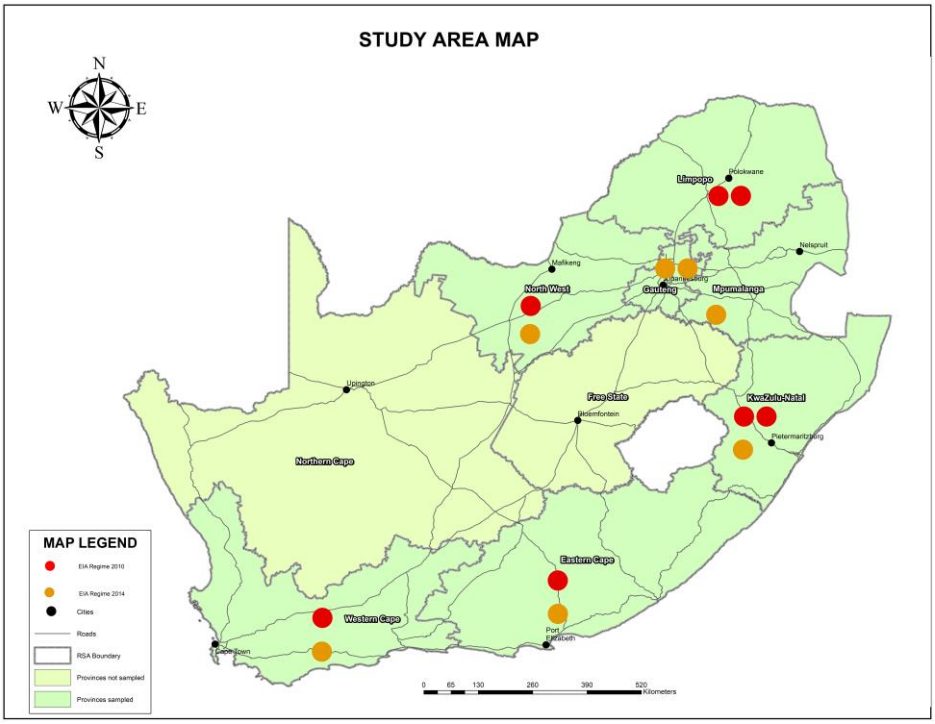

Figure 3-1: Map illustrating the study area

3.2 Data collection

The number of reports reviewed for this study was informed by the sample size of previous EIAR quality studies; 15 EIARs (Mbhele; 2009), 15 (Talime; 2011), four (Sandham *et al*., 2013), 20 scoping reports (Thorpe; 2014), 12 EIARs (Sebetlele; 2018), five (Ceronio; 2019), 24 (Sandham *et al.,* 2020), eight (Botha, 2022) and eight (Malepe *et al*., 2022).

EIARs for hazardous waste treatment facilities were obtained from the DFFE waste section (Directorate: Licensing) database on their Electronic Document Management System (EDMS). Fourteen EIARs were chosen randomly from the NEMA 2010 and NEMA 2014 EIA regimes - seven from the NEMA 2010 regime and seven from the NEMA 2014 EIA regime.

The criterion was that the documents had to be waste management licence applications for the treatment of hazardous waste listed activities. This could be an application for the treatment activity only or for other waste activities as well such as reuse and recycling, recovery and disposal of waste. The reason for specifically selecting documents related to treatment facilities was that the Directorate: Licensing receives more waste treatment applications than disposal, recovery and recycling applications. The database was not categorised per province or per the waste activity. It was a list of all waste management licence applications received in the directorate. The selection was balanced across all nine South African provinces. For the NEMA 2010 regime, two EIARs from Limpopo, one from North - West, one from the Western Cape, two from KwaZulu – Natal and

one from the Eastern Cape were sampled. For the NEMA 2014 regime one from the Eastern Cape, two from Gauteng, one from Mpumalanga, one from the Western Cape, one from North - West and one from KwaZulu – Natal were selected. Reports from the Northern Cape and Free State were not sampled because there were no projects available from those provinces. The table below shows the number of reports from each province.

Table 3-1: Table showing the number of Environmental Impact Assessment Reports (EIARs) per province

Province	**No. of EIARs for the National Environmental Management Act (NEMA) 2010 regime**	**No. of EIARs for the NEMA 2014 regime**
Limpopo	2	0
North - West	1	1
Western Cape	1	1
KwaZulu - Natal (KZN)	2	1
Eastern Cape	1	1
Gauteng	0	2
Mpumalanga	0	1

One difficulty with randomly selecting reports was that the database included all WML applications and they were not categorised according to the waste activities applied for or the regime under which each report was approved. After selection, it was therefore necessary to check the listed waste activities applied for and the EIA regime under which it was approved. Moreover, some of the folders had incomplete reports or were not scanned properly. For those applications, hard copies of the reports were requested and received.

The table below shows the EIARs from both the NEMA 2010 and NEMA 2014 regimes. The table indicates the report number, title and short name/abbreviation, the EIA regime and project decision. It must be noted that most of WML applications received in the directorate are issued with a WML and very few application are refused. This is a broad trend in all EIA research that there are very few refusals because consultants have already screened out the potential for a refusal by means of alternatives and mitigation.

Table 3-2: List of EIARs reviewed

Report number	EIA REPORT TITLE	EIA REGIME	DECISION TAKEN
1	The proposed construction and operation of a Health Care Risk Waste (HCRW) treatment facility (incineration) for medical and veterinary waste on Erf 2111 of extension 8, Laboria in the Polokwane Local Municipality, Limpopo Province **(LPL)**.	NEMA 2010	Granted
2	The proposed construction and operation of a Health Care Risk Waste (HCRW) treatment facility (autoclaving and incineration) on Portion 8 of the Waterval farm No. 303 JQ in Rustenburg in the Bojanala Platinum District Municipality in the North- West Province **(WRN)**.	NEMA 2010	Granted
3	The proposed operations of the Venetia Diamond Mine in Limpopo Province **(VDM)**.	NEMA 2010	Granted
4	The proposed Incinerator at the Middledrift prison and abattoir in the Eastern Cape Province **(MPA)**.	NEMA 2010	Granted
5	The proposed wastewater treatment works and construction of facilities for Curro Holdings in KZN Province **(CHK)**.	NEMA 2010	Granted
6	Proposed Wastewater Treatment Works in Ladismith, Western Cape **(LWC)**.	NEMA 2010	Granted
7	The proposed Chemerg waste recovery and treatment of hazardous waste facility in the KZN Province **(CWK)**.	NEMA 2010	Granted
2014 EIA reports			
8	The proposed construction and operation of a treatment facility for Tsolo Agriculture and Rural Development Institute in the jurisdiction of the Mthlontlo local Municipality, Eastern Cape Province **(TAE)**.	NEMA 2014	Granted
9	The proposed treatment and disposal of metallurgical waste on the remaining extent of portion 1 of the farm Vanderbijpark 550 IQ in the jurisdiction of Emfuleni Local Municipality, Gauteng Province **(VBG)**.	NEMA 2014	Granted
10	The proposed recovery and treatment of hazardous waste on portion 41 of the farm Weltevreden 227 IR in Delmas, Mpumalanga Province **(WDM)**.	NEMA 2014	Granted
11	The proposed treatment of industrial liquid waste on Erf 148639, 2 Tide street, Lower Woodstock in the City of Cape Town, Western Cape Province **(WCW)**.	NEMA 2014	Granted
12	The treatment of caustic residue solutions in plastic drums and flow bins on 127, Rover and Serenade roads, Elandsfontein in the jurisdiction of Ekurhuleni Metropolitan Municipality, Gauteng Province **(EEG)**.	NEMA 2014	Granted
13	The proposed treatment of general and hazardous waste on portion 75 (a portion of portion 2) of Bultfontein 475 in the jurisdiction of Madibeng Local Municipality, North - West Province **(BMN)**.	NEMA 2014	Granted
14	The proposed non - burn autoclave treatment plant on portion 8 of 50, Cato Ridge in the Ethekwini Municipality, KZN Province **(CRK)**.	NEMA 2014	Granted

3.3 Research method

The current researcher used an adapted version of the Lee and Colley review package (Lee *et al*., 1999) and applied the approach used by Sandham *et al*. (2013) and Sandham *et al*. (2020). The Lee and Colley review package has been used extensively for report quality review, both internationally and in South Africa (Sandham *et al.,* 2020; Malepe *et al*., 2022). The adapted Lee and Colley review package used was developed by Van Heerden (2010). All the review areas, categories and assessment symbols were retained because they facilitated the evaluation of EIA

best practice. The review package was further modified by Sandham *et al*. (2013), who made changes to the sub-categories and added new topics. Ten sub-categories were modified and four new sub-categories were added to fit the South African regulations. It was not necessary to further adapt the review package specifically for waste management because it facilitated a comparison of the findings with other findings on the quality of EIARs.

According to Lee *et al.* (1999:9) the following are components of the review package.

1. "*Advice for reviewers (such as the essential background information and providing guidance on the use of review criteria)*
2. *A list of review topics*
3. *A collation sheet to record the findings from using the criteria*"

The procedure is as follows: The reviewer starts the review of the EIAR at the lowest level (reviewing the sub-categories) which are simple criteria, and progressively moves to the next level (the review categories) and then reviews the areas which are more complex. The final level is the assessment of the report as a whole, with a single grade. Figure 5 below gives an indication of each level of the structure (Lee *et al*.,1999).

The four key review areas for the Lee and Colley review package (Lee *et al*.,1999:39) are as follows;

- *"Review Area 1: Description of the development and the environment;*
- *Review Area 2: Identification and evaluation of key impacts;*
- *Review Area 3: Alternatives and mitigation measures; and*
- *Review Area 4: Communication of results"*

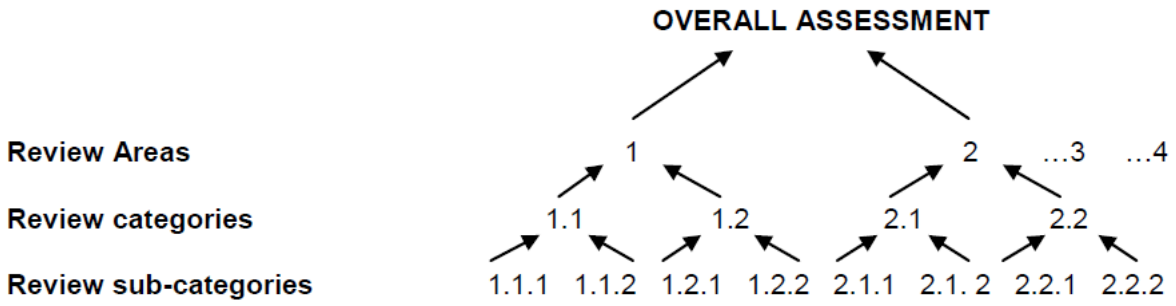

Figure 3-2: The Lee and Colley review package hierarchical structure (Lee *et al*., 1999)

According to Lee *et al*. (1999), a standard list of assessment symbols is used by the reviewer to record the results of the assessment for each criterion on a collation sheet. Table 3 below shows the symbols and their description. Symbols A-C are considered satisfactory, D-F are considered unsatisfactory and N/A is not applicable.

Table 3-3: Description of assessment symbols (Lee *et al*., 1999:11)

Quality level		
Symbol	*Reason*	*Grouping*
A	*"Relevant tasks well performed, no important task left incomplete*	*Satisfactory*
B	*Generally satisfactory and complete, only minor omissions and inadequacies*	
C	*Can be considered just satisfactory despite omissions and/or inadequacies*	
D	*Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies.*	*Unsatisfactory*
E	*Not satisfactory, significant omissions or inadequacies*	
F	*Very unsatisfactory, important task (s) poorly performed or not attempted.*	
N/A	*Not applicable. The review topic is not applicable or it is irrelevant in the context of this report".*	*Not applicable*

Table 3-4 below contains a summary of the review areas, categories and sub-categories. For the complete review package, see Appendix A.

Table 3-4: Summary of Van Heerden (2010) adapted review package

RA 1	**DESCRIPTION OF DEVELOPMENT AND ENVIRONMENT**	**RA 2**	**IMPACT IDENTIFICATION AND EVALUATION**	**3.2**	**Scope and effectiveness of mitigation measures**
1.1	**Description of the development**	**2.1**	**Definition of impacts**	3.2.1	Consider mitigation of all significant adverse impacts
1.1.1	Purpose and objectives	2.1.1	All possible effects on the environment	3.2.2	Mitigation measures
1.1.2	Design and size	2.1.2	Interaction of effects	3.2.3	Extent of effectiveness of mitigation when implemented
1.1.3	Presence and appearance of completed development	2.1.3	Impacts from non-standard operating procedure	**3.3**	**Commitment of mitigation**
1.1.4	Nature of production processes	2.1.4	Impacts from deviation from base-line conditions	3.3.1	Record of commitment to mitigation measures
1.1.5	Nature and quality of raw materials			3.3.2	Monitoring arrangements
1.1.6	Identification of applicant	**2.2**	**Identification of impacts**	**RA 4**	**COMMUNICATION OF RESULTS**
1.1.7	Details of EAP to carry out assessment	2.2.1	Impacts identification methodology	**4.1**	**Layout of the report**
		2.2.2	Impact identification method used	4.1.1	Information logically arranged
1.2	**Site description**			**4.1.2**	**Information logically arranged**
1.2.1	Area of development site	**2.3**	**Scoping**	4.1.3	Chapter summaries
1.2.2	Demarcation of land use area	2.3.1	Contact general public and special interest groups	4.1.4	External sources acknowledged
1.2.3	Duration of different phases	2.3.2	Collect opinions and concerns of I&APs		
1.2.4	Estimated number of workers and/or visitors	2.3.3	Key impacts	**4.2**	**Presentation**
1.2.5	Means of transporting raw materials, products and quantities			4.2.1	Presentation of information
		2.4	**Prediction of impact significance**	4.2.2	Technical terms, acronyms, initials defined
1.3	**Waste**	2.4.1	Data to estimate magnitude of main impacts	4.2.3	Statement presented as an integrated whole
1.3.1	Waste streams	2.4.2	Methods used to predict impact magnitude		
1.3.2	Treatment, disposal and disposal routes	2.4.3	Predictions of impact measurable quantities	**4.3**	**Emphasis**
1.3.3	Methods of obtaining quantity of wastes			4.3.1	Emphasis to potentially severe impacts
		2.5	**Assessment of impact significance**	4.3.2	Statement must be unbiased
1.4	**Environmental description**	2.5.1	Significance of impact on affected community and society in general	4.3.3	Opinion as to whether activity should/should not be authorised
1.4.1	Area to be affected by development	2.5.2	Significance ito national and international quality standards		
1.4.2	Effects occurring away from immediate affected environment	2.5.3	Justification of proposed methods of assessing significance	4.4	**Non – technical summary**
				4.4.1	Non-technical summary of main findings & conclusions
1.5	**Baseline conditions**	**RA 3**	**ALTERNATIVES AND MITIGATION**	4.4.2	Summary must cover all main issues
1.5.1	Important components of the affected environment	3.1	Alternatives		
1.5 .2	Existing data sources	3.1.1	Description of alternatives sites		
1.5.3	Local land use plans, policies consulted	3.1.2	Description of alternative processes, design and operating conditions		
		3.1.3	For severe adverse impacts rejected alternative identified		
		3.1.4	Comparative assessment of all alternatives identified		

3.4 Data analysis

Lee *et al.* (1999) recommends that the EIARs be reviewed independently by two reviewers. Any important differences in the assessment of specific review areas between the two reviewers should be analytically examined by them to see whether they can be resolved and achieve a consensus.

For this research, the EIARs were therefore reviewed by two experienced independent reviewers using the adapted Lee and Colley review package described above. The reviewers are familiar with the minimum requirements, as stipulated in the EIA regulations of South Africa. A collation sheet was used by both reviewers to record their findings (Appendix B). After the independent reviews, the grades were discussed to achieve consensus, and these agreed - upon grades were used in the results of the study.

The collation sheets do not only make it possible to record the findings by indication of the symbol, but also to briefly summarise the principal strengths and weaknesses of the EIARs assessed (Lee *et al.,* 1999). Therefore, for this study, the strengths and weaknesses were identified, and the results were analysed with a view to improving EIA practice for hazardous waste facilities in South Africa.

3.5 Methodological assumptions and limitations

The methodology used only focuses on the quality of EIARs in terms of legislative requirements and best practice.

3.6 Ethical considerations

The study followed and adhered to the North West University ethical clearance process. The Faculty of Natural and Agricultural Sciences Ethics Committee cleared the study as no ethical risk with ethics number: NWU-01284-19-A9. EIARs which were obtained from the DFFE, directorate Licensing were reviewed and assessed by the researcher and a colleague.

3.7 Chapter summary

The chapter contained a description of the study area, the data collection and the method used for the study. The results and analysis of the reviewed EIARs are provided in the following chapter.

CHAPTER 4: DATA ANALYSIS AND DISCUSSION

In this chapter, the results of the quality of the review of 14 EIARs, of which seven fall under the NEMA 2010 regime and seven under the NEMA 2014 EIA regimes, are presented. The review process generated findings on the quality of the sample of EIARs for a sample of hazardous waste treatment facilities in South Africa. Strengths and weaknesses were identified in the review areas. For this paper, names of the Review Areas, categories and sub-categories will be in capital letters and numerical values of grades for ease of reading.

The assessment symbols A (well performed, with no important tasks left incomplete), B (generally satisfactory and complete with minor commissions), C (just satisfactory), D (just unsatisfactory), E (not satisfactory) and F (very unsatisfactory) are used to indicate the performance of the reports.

The symbols A-C were grouped together to indicate satisfactory and symbols A -B were grouped together to indicate excellence (strength). Symbols D-F were grouped together to indicate unsatisfactory and E-F were grouped together to indicate a weakness.

Table 4-1: grouping of symbols

PERCENTAGE	GRADE	STRENGTH/WEAKNESS
86%	A-B	strength
29% - 56%	E-F	moderate weakness
57% and above	E-F	weakness

The results for the reports that fell under the NEMA 2010 EIA regime are presented first and those for the NEMA 2014 regime follow.

4.1 NEMA 2010 regime sample

The overall quality of the reports are indicated first, followed by the results for the four review areas (RA 1, RA 2, RA 3 and RA 4), the categories and sub-categories. The NEMA 2010 regime sample comprised seven reports.

1. The proposed construction and operation of a Health Care Risk Waste treatment facility (incineration) for medical and veterinary waste on Erf 2111 of extension 8, Laboria in the Polokwane Local Municipality, Limpopo Province **(LPL)**.

2. The proposed construction and operation of a Health Care Risk Waste treatment facility (autoclaving and incineration) on Portion 8 of the Waterval farm No. 303 JQ in Rustenburg within the Bojanala Platinum District Municipality in the North-West Province **(WRN)**.

3. The proposed operations of the Venetia Diamond Mine in Limpopo Province **(VDM)**.

4. The proposed incinerator at the Middledrift prison and abattoir in the Eastern Cape Province **(MPA)**.

5. The proposed Wastewater Treatment Works and construction of facilities for Curro Holdings in the KZN Province **(CHK)**.

6. Proposed Wastewater Treatment Works in Ladismith, Western Cape **(LWC)**.

7. The proposed Chemerg waste recovery and treatment of hazardous waste facility in KZN **(CWK)**.

4.1.1 Overall quality of the EIA 2010 regime sample

Six reports (86%) were graded as satisfactory (A-C) of which four (57%) were graded excellent (A-B). One report (14%) was graded as unsatisfactory (D-F). Four of the reports (LPL, WRN, LWC, CWK) were graded B, two reports (KKN, MPA) were graded C and one report (CHK) was graded D. No reports were graded E and F. The complete set of grades (raw data) can be found in appendix C.

Table 4-2 below contains a summary of the overall grades, the Review Areas (RA), and review categories for the seven (2010 regime) EIA reports.

Table 4-2: Summary of the overall grades for the 2010 EIA regime

Hazardous Waste Treatment Facilities EIARs [n= 7] 2010												
Summary of review areas, categories and sub-categories		**LPL**	**WRN**	**VDM**	**MPA**	**CHK**	**LWC**	**CWK**	**% A-C**	**% A-B**	**%D-F**	**% E-F**
Overall grade		B	B	C	C	D	B	B	86 (6)	57 (4)	14 (1)	0
RA 1	Description of project and environment	B	B	C	C	C	B	B	100 (7)	57 (4)	0	0
1.1	Description of the development	B	A	B	B	B	B	B	100 (7)	100 (7)	0	0
1.2	Site description	B	C	D	C	D	C	C	71 (5)	14 (1)	29 (2)	0
1.3	Waste	B	A	C	C	C	C	B	100 (7)	43 (3)	0	0
1.4	Environmental description	B	A	C	B	D	B	B	86 (6)	71 (5)	14 (1)	0
1.5	Baseline conditions	A	A	D	C	E	B	C	71 (5)	43 (3)	14 (1)	0
RA 2	Impact identification and evaluation	B	B	C	C	D	C	B	86 (6)	43 (3)	14 (1)	0
2.1	Definition of impacts	B	B	C	C	D	C	B	86 (6)	43 (3)	14 (1)	0
2.2	Identification of impacts	B	B	D	C	E	B	C	71 (5)	43 (3)	29 (2)	29 (2)
2.3	Scoping	B	A	C	B	B	B	B	100 (7)	86 (6)	0	0
2.4	Prediction of impact magnitude	B	B	D	C	E	C	B	71 (5)	43 (3)	29 (2)	0
2.5	Assessment of impact significance	B	B	B	B	F	B	B	86 (6)	86 (6)	14 (1)	14 (1)
RA 3	Alternatives and mitigation	C	C	C	C	E	B	B	86 (6)	29 (2)	14 (1)	14 (1)
3.1	Alternatives	C	C	C	D	D	A	C	71 (5)	14 (1)	29 (2)	0
3.2	Scope and effectiveness of mitigation measures	B	B	C	B	F	B	B	86 (6)	71 (5)	14 (1)	14 (1)
3.3	Commitment of mitigation	B	B	B	C	D	B	B	86 (6)	71 (5)	14 (1)	0
RA 4	Communication of results	B	A	B	C	D	B	B	86 (6)	71 (5)	14 (1)	0
4.1	Layout of the report	B	B	B	D	E	B	B	71 (5)	71 (5)	29 (2)	14 (1)
4.2	Presentation	A	A	A	A	D	A	A	86 (6)	86 (6)	14 (1)	0
4.3	Emphasis	B	B	B	A	D	B	A	86 (6)	86 (6)	14 (1)	0
4.4	Non-technical summary	B	A	B	B	D	C	A	86 (6)	86 (6)	14 (1)	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.1.2 Quality of Review Areas for the 2010 regime

The four review areas (Description of project and environment, identification and evaluation of key impacts, alternatives and mitigation and communication of results) for the 2010 EIA regime are discussed below.

4.1.2.1 Review Area 1 – Description of project and environment (2010 regime)

RA 1 refers to the description of the development, description of the site where the development would be located, waste streams, the environment affected and the baseline conditions. Seven reports (100%) were graded satisfactory, of which four (57%) were graded excellent (A and B). Four of the reports were graded as B and two reports as C. Description of the development was graded 1A, 6Bs, Site description 1B, 4Cs and 2Ds, Wastes 1A, 2Bs and 4Cs, Environment description 1A, 4Bs, 1 C and 1D, Baseline conditions graded 2As, 1B, 2Cs, 1D and 1E. Table 6 below indicates that sub-categories 1.1 (Description of the environment), 1.1.6 (Identification of the applicant) and 1.1.7 (Details of the EAP who carried out the assessment) were identified as strengths, with 100% A-B grades. Sub-categories 1.1.5 (Nature and quantities of raw materials), with 29% A-C and 29% E-F, 1.2.4 (Number of workers and/or visitors) with 43% E-F, and 1.2.5 (Means of transport raw materials, products and quantities) with 29% E-F, were identified as moderate weaknesses whereas 1.2.3 (Duration of different phases) with 57% E-F was identified as an area of weakness.

Table 4-3: Summary of Review Area 1 for the 2010 EIA regime [n= 7]

Summary of review areas, categories and sub-categories	LPL	WRN	VDM	MPA	CHK	LWC	CWK	% A-C	% A-B	% D-F	% E-F
1.Description of project and environment	B	B	C	C	C	B	B	100 (7)	57 (4)	0	0
1.1 Description of the development	B	A	B	B	B	B	B	100 (7)	100 (7)	0	0
1.1.1 Purpose (s) and objectives	A	A	A	A	C	B	A	100 (7)	86 (6)	0	0
1.1.2 Design and size of development	B	C	A	A	A	C	A	100 (7)	71 (5)	0	0
1.1.3 Physical presence and appearance of completed development	C	B	A	C	C	C	B	100 (7)	43 (3)	0	0
1.1.4 Nature of production processes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1.1.5 Nature and quantities of raw materials	C	F	C	D	E	D	D	29 (2)	0	71 (5)	29 (2)
1.1.6 Identification of applicant	A	A	A	A	A	A	A	100 (7)	100 (7)	0	0
1.1.7 Details of EAP to carry out assessment	A	A	A	A	C	A	A	100 (7)	100 (7)	0	0
1.2 Site description	B	C	D	C	D	C	C	71 (5)	14 (1)	29 (2)	0
1.2.1 Area of development site	A	B	C	C	A	C	A	100 (7)	57 (4)	0	0
1.2.2 Demarcation of land use areas	A	B	D	C	D	B	A	71 (5)	57 (4)	29 (2)	0
1.2.3 Estimated duration of different phases	A	E	D	E	E	C	E	29 (2)	14 (1)	71 (5)	57 (4)
1.2.4 Number of workers and/or visitors	A	E	D	D	E	D	E	14 (1)	14 (1)	86 (6)	43 (3)
1.2.5 Means of transporting raw materials, products and quantities	C	C	C	C	E	B	E	71 (5)	14 (1)	29 (2)	29 (2)
1.3 Wastes	B	A	C	C	C	C	B	100 (7)	43 (3)	0	0
1.3.1 Waste streams and quantities	B	A	C	C	C	C	B	100 (7)	43 (3)	0	0
1.3.2 Treatment, disposal and disposal routes	A	A	C	C	D	B	A	86 (6)	57 (4)	14 (1)	0
1.3.3 Methods of obtaining quantity of wastes	A	A	C	C	D	C	B	86 (6)	43 (3)	0	0
1.4 Environmental description	B	A	C	B	D	B	B	86 (6)	71 (5)	14 (1)	0
1.4.1 Environment to be affected by development	A	A	C	C	C	B	B	100 (7)	57 (4)	0	0
1.4.2 Effects occurring away from immediate affected environment	B	B	C	C	D	C	C	86 (6)	29 (2)	14 (1)	0
1.5 Baseline conditions	A	A	D	C	E	B	C	71 (5)	29 (2)	29 (2)	14 (1)
1.5.1 Important components of the affected environment	A	B	D	E	E	B	C	57 (4)	43 (3)	43 (3)	29 (2)
1.5.2 Existing data sources	A	A	D	C	E	B	C	71 (5)	43 (3)	29 (2)	14 (1)
1.5.3 Local land use plans, policies consulted	A	A	D	C	D	B	C	71 (5)	43 (3)	29 (2)	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.1.2.2 Review Area 2 – Identification and evaluation of key impacts (2010 regime)

RA 2 refers to the definition and identification of impacts, scoping and the prediction and assessment of impact significance. Six reports (86%) were graded as satisfactory (A – C) of which three (43 %) were graded as excellent (A – B) and one report (14%) was graded as unsatisfactory (D-F).

The definition of impacts was graded 3Bs, 3Cs and 1D, identification of impacts 3Bs, 2Cs, 1D and 1E, scoping 1A, 5Bs and 1C, prediction of impacts 3Bs, 2Cs, 1D and 1E, assessment of impact significance 6Bs and 1F.

Table 4-4 below indicates that sub-categories 2.3.1 and 2.3.2 (Stakeholder engagement) received excellent scores with 100% A-B grades and category 2.5 (Assessment of impact significance) were assessed as excellent with 86% A-B grades and regarded as strengths. Subcategory 2.1.3 (Impacts from non-standard operating procedure) was identified as a weakness, with 57% being very unsatisfactory E -F. Sub -categories 2.1.4 (Impacts from deviation from base-line conditions), 2.2 (Identification of impacts), 2.2.2 (Method used to identify impacts) and 2.4.3 (Predictions of impact in measurable quantities) were identified as areas of moderate weakness with 29% E-F grades.

Table 4-4: Summary of Review Area 2 for the 2010 EIA regime [n= 7]

Summary of review areas, categories and sub-categories	LPL	WRN	VDM	MPA	CHK	LWC	CWK	% A-C	% A-B	% D-F	% E-F
2 Impact identification and evaluation	B	B	C	C	D	C	B	86 (6)	43 (3)	14 (1)	0
2.1 Definition of impacts	B	B	C	C	D	C	B	86 (6)	43 (3)	14 (1)	0
2.1.1 All possible effects on environment	B	B	C	C	D	B	B	86 (6)	57 (4)	14 (1)	0
2.1.2 Interaction of effects	B	B	D	C	D	B	B	71 (5)	57 (4)	29 (2)	0
2.1.3 Impacts from non-standard operating procedure	A	C	E	E	E	E	C	43 (3)	14 (1)	57 (4)	57 (4)
2.1.4 Impacts from deviation from base-line conditions	C	C	E	D	E	C	B	57 (4)	14 (1)	43 (3)	29 (2)
2.2 Identification of impacts	B	B	D	C	E	B	C	71 (5)	43 (3)	29 (2)	29 (2)
2.2.1 Impacts identification methodology	B	B	D	C	E	C	C	71 (5)	29 (2)	29 (2)	14 (1)
2.2.2 Impact identification method used	B	C	E	C	E	B	C	71 (5)	29 (2)	29 (2)	29 (2)
2.3 Scoping	B	A	C	B	B	B	B	100 (7)	86 (6)	0	0
2.3.1 Contact general public and special interest groups	A	A	A	A	A	A	A	100 (7)	100 (7)	0	0
2.3.2 Collect opinions and concerns of I&APs	A	A	A	A	A	A	A	100 (7)	100 (7)	0	0
2.3.3 Key impacts	B	B	C	C	D	C	B	86 (6)	43 (3)	14 (1)	0
2.4 Prediction of impact magnitude	B	B	D	C	E	C	B	71 (5)	43 (3)	29 (2)	14 (1)
2.4.1 Data to estimate magnitude of main impacts	B	C	D	C	E	C	B	71 (5)	29 (2)	29 (2)	14 (1)
2.4.2 Methods used to predict impact magnitude	A	B	D	C	E	C	B	71 (5)	43 (3)	29 (2)	14 (1)
2.4.3 Predictions of impact in measurable quantities	B	B	D	C	E	C	B	71 (5)	43 (3)	29 (2)	29 (2)
2.5 Assessment of impact significance	B	B	B	B	F	B	B	86 (6)	86 (6)	14 (1)	14 (1)
2.5.1 Significance of impact on affected community and society in general	B	C	C	B	F	A	A	86 (6)	57 (4)	14 (1)	14 (1)
2.5.2 Significance of national and international quality standards	A	A	A	A	F	A	A	86 (6)	86 (6)	14 (1)	14 (1)
2.5.3 Justification of proposed methods of assessing significance	C	B	C	B	E	C	C	86 (6)	29 (2)	14 (1)	14 (1)

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.1.2.3 Review Area 3 – Alternatives and mitigation (2010 regime)

RA 3 refers to the project alternatives, scope and effectiveness of mitigation measures and the commitment to the mitigation measures identified. Six reports (86%) were graded satisfactory (A-C) of which two reports (29%) were graded excellent (A-B). One report (14%) was graded unsatisfactory (E-F). Alternatives was graded 1A, 4Cs and 2Ds, scope and effectiveness of mitigation measures graded 5Bs, 1C and 1F and commitment to mitigation measures received 5Bs, 1Cand 1D.

Sub-category 3.3.1 (record of commitment to mitigation measures) was identified as a strength with six reports (86%) graded A-B, whereas 3.1.4 (comparative assessment of all alternatives identified) was identified as a weakness with six reports (86%) being graded D-F and five reports (71%) grades E-F. Sub- categories 3.1.3 (For severe adverse impacts rejected alternatives identified) and 3.2.3 (Extent of effectiveness of mitigation when implemented) were identified as moderate weaknesses with two reports (29%) graded E-F.

Table 4-5: Summary of Review Area 3 for the 2010 EIA regime [n= 7]

Summary of all review areas, categories and sub-categories	LPL	WRN	VDM	MPA	CHK	LWC	CWK	% A-C	% A-B	%D-F	% E-F
3 Alternatives and mitigation	C	C	C	C	E	B	B	86 (6)	29 (2)	14 (1)	14 (1)
3.1 Alternatives	C	C	C	D	D	A	C	71 (5)	14 (1)	29 (2)	0
3.1.1 Description of alternative sites	A	C	C	C	D	B	A	86 (6)	43 (3)	14 (1)	0
3.1.2 Description of alternative processes, design and operating conditions	B	C	C	C	D	C	A	86 (6)	29 (2)	14 (1)	0
3.1.3 For severe adverse impacts rejected alternative identified	C	D	C	C	E	B	E	57 (4)	14 (1)	43 (3)	29 (2)
3.1.4 Comparative assessment of all alternatives identified	D	E	E	E	E	B	E	14 (1)	14 (1)	86 (6)	71 (5)
3.2 Scope and effectiveness of mitigation measures	B	B	C	B	F	B	B	86 (6)	71 (5)	14 (1)	14 (1)
3.2.1 Consider mitigation of all significant adverse impacts	A	A	B	C	F	A	A	86 (6)	71 (5)	14 (1)	14 (1)
3.2.2 Mitigation measures	B	B	C	C	F	B	A	86 (6)	57 (4)	14 (1)	14 (1)
3.2.3 Extent of effectiveness of mitigation when implemented	C	C	C	C	F	B	E	71 (5)	14 (1)	29 (2)	29 (2)
3.3 Commitment of mitigation	B	B	B	C	D	B	B	86 (6)	71 (5)	14 (1)	0
3.3.1 Record of commitment to mitigation measures	A	A	B	B	D	B	A	86 (6)	86 (6)	14 (1)	0
3.3.2 Monitoring arrangements	B	B	B	C	D	C	B	86 (6)	57 (4)	14 (1)	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.1.2.4 Review Area 4 -Communication of results (2010 regime)

RA 4 refers to the layout of the report, how it was presented, emphasis on key matters and the non-technical summary. Six reports (86%) were graded as satisfactory (A-C) of which two (29%) were graded as excellent (A-B). One report (14%) was graded unsatisfactory (D-F). Report layout was graded 5Bs and 2Ds, Presentation was graded 6As and 2Ds, Emphasis was graded 2As, 4Bs and 1D and Non – technical summary received 2As, 3Bs, 1C and 1D.

Table 4-6 below indicates that sub-category 4.3.3 (The opinion as to whether the activity should/ should not be authorised) was identified as a strength with seven (100%) graded as excellent (A-B). Information logically arranged (4.1.2), Presentation (4.2), Presentation of information (4.2.1), Technical terms, acronyms, initials defined (4.2.2), Statement presented as an integrated whole (4.2.3), Emphasis (4.3) and Unbiased statement (4.3.3) were identified as areas of strength with six reports (86%) graded A-B. The acknowledgement of external sources (4.1.4) was identified as a weakness with four reports (57%) graded as very unsatisfactory (E-F).

Table 4-6: Summary of Review Area 4 for the 2010 EIA regime [n= 7]

Summary of categories and sub-categories	LPL	WRN	VDM	MPA	CHK	LWC	CWK	% A-C	% A-B	% D-F	% E-F
4 Presentation and Communication	B	A	B	C	D	B	B	86 (6)	71 (5)	14 (1)	0
4.1 Layout of the report	B	B	B	D	E	B	B	71 (5)	71 (5)	29 (2)	0
4.1.1 Introduction	A	A	A	A	D	C	A	86 (6)	71 (5)	14 (1)	0
4.1.2 Information logically arranged	A	A	A	A	E	A	A	86 (6)	86 (6)	14 (1)	14 (1)
4.1.3 Chapter summaries	C	B	C	B	E	B	B	86 (6)	57 (4)	14 (1)	14 (1)
4.1.4 External sources acknowledged	E	A	E	E	E	B	B	43 (3)	43 (3)	57 (4)	57 (4)
4.2 Presentation	A	A	A	A	D	A	A	86 (6)	86 (6)	14 (1)	14 (1)
4.2.1 Presentation of information	A	A	A	A	C	A	A	100 (7)	86 (6)	0	0
4.2.2 Technical terms, acronyms, initials defined	A	A	A	A	E	A	A	86 (6)	86 (6)	14 (1)	14 (1)
4.2.3 Statement presented as an integrated whole	A	A	A	A	C	A	A	86 (6)	86 (6)	0	0
4.3 Emphasis	B	B	B	A	D	B	A	86 (6)	86 (6)	14 (1)	0
4.3.1 Emphasis to potentially severe impacts	B	B	C	A	D	B	A	86 (6)	71 (5)	14 (1)	0
4.3.2 Statement must be unbiased	B	B	A	A	C	B	A	100 (7)	86 (6)	0	0
4.3.3 Opinion as to whether activity should/should not be authorised	B	B	A	A	B	A	A	100 (7)	100 (7)	0	0
4.4 Non- technical summary	B	A	B	B	D	C	A	86 (6)	71 (5)	14 (1)	0
4.4.1 Non-technical summary of main findings & conclusions	B	A	B	A	C	C	A	100 (7)	71 (5)	0	0
4.4.2 Summary must cover all main issues	B	A	A	C	C	C	A	100 (7)	57 (4)	0	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

Reports LPL, WRN, VDM, MPA, LWC and CWK performed well, with LPL identified as the strongest project because it received many A-B grades while CHK was identified as having the weakest project performance, with many E-F grades. The paper now moves to the discussion on the 2014 regime.

4.2 NEMA 2014 EIA regime sample

The results for the sample of seven reports from the 2014 regime are discussed below. The NEMA 2014 EIA regime sample comprised seven reports.

1. The proposed construction and operation of a treatment facility for the Tsolo Agriculture and Rural Development Institute in the jurisdiction of the Mthlontlo local Municipality, Eastern Cape Province **(TAE)**.

2. The proposed treatment and disposal of metallurgical waste on the remaining extent of portion 1 of the farm Vanderbijpark 550 IQ in the jurisdiction of Emfuleni Local Municipality, Gauteng Province **(VBG)**.

3. The proposed recovery and treatment of hazardous waste on portion 41 of the farm Weltevreden 227 IR in Delmas, Mpumalanga Province **(WDM)**.

4. The proposed treatment of industrial liquid waste on Erf 148639, 2 Tide street, Lower Woodstock in the City of Cape Town, Western Cape Province **(WCW)**.

5. The treatment of caustic residue solutions in plastic drums and flow bins on 127, Rover and Serenade roads, Elandsfontein in the jurisdiction of Ekurhuleni Metropolitan Municipality, Gauteng Province **(EEG)**.

6. The proposed treatment of general and hazardous waste on portion 75 (a portion of portion 2) of the Bultfontein 475 in the jurisdiction of Madibeng Local Municipality, North- West Province **(BMN)**.

7. The proposed non - burn autoclave treatment plant on portion 8 of 50, Cato Ridge in the Ethekwini Municipality, KZN Province **(CRK)**.

4.2.1 Overall quality of EIA report samples (2014 regime)

Six reports (86%) were graded as satisfactory (A – C), of which three (43%) were graded excellent (A-B) and one report (14%) was graded as unsatisfactory (D-F).

Three reports (VBG, WDM, WCW) were graded A, three reports (EEG, BMN, CRK) were graded C and one report (TAE) was graded D. Table 10 below is a summary of the overall scoring of the EIARs for the NEMA 2014 EIA regime sample.

Table 4-7: Summary of the overall grades for the 2014 EIA regime

Hazardous Waste Treatment Facilities EIARs [n= 7]												
Summary of review areas, categories and sub-categories		TAE	VBG	WDM	WCW	EEG	BMN	CRK	% A-C	% A-B	%D-F	% E-F
Overall grade		D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
RA 1	Description of project and environment	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
1.1	Description of the development	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
1.2	Site description	D	C	B	B	D	D	C	57 (4)	29 (2)	43(3)	0
1.3	Waste	C	A	B	A	C	B	B	100 (7)	71 (5)	0	0
1.4	Environmental description	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.5	Baseline conditions	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
RA 2	Impact identification and evaluation	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
2.1	Definition of impacts	D	B	B	B	D	C	C	71 (5)	43 (3)	29 (2)	0
2.2	Identification of impacts	C	A	B	A	B	B	C	100 (7)	71 (5)	0	0
2.3	Scoping	C	A	A	A	C	C	A	100 (7)	57 (4)	0	0
2.4	Prediction of impact magnitude	D	A	A	A	C	C	A	86 (6)	57 (4)	14 (1)	0
2.5	Assessment of impact significance	C	A	A	B	B	B	C	100 (7)	71 (5)	0	0
RA 3	Alternatives and mitigation	D	A	B	A	C	D	B	71 (5)	57 (4)	29 (2)	0
3.1	Alternatives	D	A	C	A	D	D	B	57 (4)	43 (3)	43 (3)	0
3.2	Scope and effectiveness of mitigation measures	D	A	A	A	B	D	B	71 (5)	71 (5)	29 (2)	0
3.3	Commitment of mitigation	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
RA 4	Communication of results	D	A	A	A	D	C	B	57 (4)	57 (4)	29 (2)	0
4.1	Layout of the report	D	A	A	A	D	C	B	57 (4)	57 (4)	29 (2)	0
4.2	Presentation	D	A	A	A	D	B	A	71 (5)	71 (5)	29 (2)	0
4.3	Emphasis	D	A	A	B	C	C	B	57 (4)	57 (4)	14 (1)	0
4.4	Non-technical summary	C	B	B	A	F	C	B	86 (6)	57 (4)	14 (1)	14 (1)

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.2.2 Quality of Review Area (2014 regime)

The four review areas (description of project and environment, identification and evaluation of key impacts, alternatives and mitigation and communication of results) for the 2014 EIA regime are discussed below.

4.2.2.1 Review Area 1 – Description of project and environment (2014 regime)

Seven reports (100%) were graded as satisfactory of which four (57%) were graded as excellent (A and B). Three reports had a grading of A, one report graded B and three reports with a C. Description of the development was graded 3As, 1B and 3Cs, site description 2Bs, 2Cs and 3Ds, wastes 2As, 3Bs and 2Cs, environment description 3As, 3Cs and 1D, and baseline conditions 3As, 3Cs, 1D.

Table 4-8 below indicates that sub-categories 1.1.7 (Details of the EAP who carried out the assessment) with seven reports (100%) graded A-B, 1.1.6 (Identification of the applicant) and 1.3.2 (Treatment, disposal and disposal routes) with six reports (86%) graded A-B (excellent performance) were identified as strengths. Sub-categories 1.2.3 (Duration of different phases)

graded 71% and 1.2.4 (The number of workers and/visitors) were identified as weaknesses, with seven reports (100%) graded very unsatisfactory (E-F). Sub-category 1.1.4 was not applicable for all reports due to the nature of the project activities.

Table 4-8: Summary of Review Area 1 for the 2014 EIA regime [n= 7]

Summary of review areas, categories and sub-categories	TAE	VBG	WDM	WCW	EEG	BMN	CRK	% A-C	% A-B	% D-F	% E-F
1.Description of project and environment	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
1.1 Description of the development	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
1.1.1 Purpose and objectives	C	A	A	A	E	C	C	86 (6)	43 (3)	14 (1)	14 (1)
1.1.2 Design and size	C	A	A	A	D	C	A	86 (6)	57 (4)	14 (1)	0
1.1.3 Presence and appearance of completed development	C	B	A	B	D	C	C	86 (6)	43 (3)	14 (1)	0
1.1.4 Nature of production processes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1.1.5 Nature and quantities of raw materials	E	B	A	B	D	D	C	57 (4)	43 (3)	43 (3)	14 (1)
1.1.6 Identification of applicant	A	A	A	A	B	C	B	100 (7)	86 (6)	0	0
1.1.7 Details of EAP to carry out assessment	A	A	A	A	A	A	A	100 (7)	100 (7)	0	0
1.2 Site description	D	C	B	B	D	D	C	71 (4)	29 (2)	43 (3)	0
1.2.1 Area of development site	B	A	A	A	C	C	A	100 (7)	71 (5)	0	0
1.2.2 Demarcation of land use areas	D	A	A	B	D	B	A	71 (5)	71 (5)	0	0
1.2.3 Duration of different phases	E	E	C	A	E	E	E	29 (2)	14 (1)	71 (5)	71 (5)
1.2.4 Number of workers and/or visitors	E	E	E	E	E	E	E	100 (7)	0	100(7)	100 (7)
1.2.5 Means of transporting raw materials, products and quantities	C	B	B	A	D	D	D	71 (4)	43 (3)	43 (3)	0
1.3 Waste	C	A	B	A	C	B	B	100 (7)	71 (5)	0	0
1.3.1 Waste streams and quantities	C	A	A	A	C	B	B	86 (6)	71 (5)	0	0
1.3.2 Treatment, disposal and disposal routes	D	A	A	A	B	B	A	86 (6)	86 (6)	14 (1)	0
1.3.3 Methods of obtaining quantity of wastes	C	A	C	A	C	B	B	100 (7)	57 (4)	0	0
1.4 Environmental description	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.4.1 Area to be affected by development	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.4.2 Effects occurring away from immediate affected environment	D	A	A	A	D	C	C	71 (5)	43 (3)	29 (2)	0
1.5 Baseline conditions	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.5.1 Important components of the affected environment	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.5.2 Existing data sources	D	A	A	A	C	C	C	86 (6)	43 (3)	14 (1)	0
1.5.3 Local land use plans, policies consulted	D	A	A	A	C	C	C	43 (3)	43 (3)	14 (1)	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.2.2.2 Review Area 2 – Identification and evaluation of key impacts (2014 regime)

Seven reports (100%) were graded as satisfactory (A –C), of which four reports (57%) were graded as excellent (A – B). Definition of impacts received 3Bs, 2Cs and 2Ds, Identification of impacts was graded 2As,3Bs, 2Cs, scoping was graded 4As and 3Cs, prediction of impacts received 4As, 2Cs, 1D and assessment of impact significance was graded 2As, 3Bs and 2Cs.

As indicated in Table 12 below, sub-categories 2.3.1 (Contact of the general public and special interest groups), with 100% (7) graded A-B, 2.2.1 (Impacts identification methodology), 2.2.2 (Impact identification method used), sub – category 2.5.2 (Significance of national and international quality standards) and sub – category 2.5.3 (The justification of the proposed methods of assessing significance) with 86% and graded A-B, were identified as strengths for RA 2. Sub – category 2.1.3 (Impacts from non-standard operating procedure) was identified as a moderate weakness with five reports (75%) graded unsatisfactory (D-F) and two reports (29 %) graded very unsatisfactory (E-F).

Table 4-9: Summary of Review Area 2 for the 2014 EIA regime [n= 7]

Summary of categories and sub-categories	TAE	VBG	WDM	WCW	EEG	BMN	CRK	% A-C	% A-B	% D-F	% E-F
2 Impact identification and evaluation	C	A	A	A	C	C	B	100(7)	57 (4)	0	0
2.1 Definition of impacts	D	B	B	B	D	C	C	71 (5)	43 (3)	29 (2)	0
2.1.1 All possible effects on environment	D	B	B	B	C	C	C	86 (6)	43 (3)	14 (1)	0
2.1.2 Interaction of effects	D	B	B	A	C	C	C	86 (6)	43 (3)	14 (1)	0
2.1.3 Impacts from non-standard operating procedure	D	B	C	D	E	E	D	29 (2)	14 (1)	71 (5)	29 (2)
2.1.4 Impacts from deviation from base-line conditions	D	A	C	B	D	C	C	71 (5)	29 (2)	29 (2)	0
2.2 Identification of impacts	C	A	B	A	B	B	C	100(7)	71 (5)	0	0
2.2.1 Impacts identification methodology	C	A	B	A	B	B	B	100(7)	86 (6)	0	0
2.2.2 Impact identification method used	C	A	A	A	A	A	A	100(7)	86 (6)	0	0
2.3 Scoping	C	A	A	A	C	C	A	100(7)	57 (4)	0	0
2.3.1 Contact general public and special interest groups	C	A	A	A	A	A	A	100(7)	100(6)	0	0
2.3.2 Collect opinions and concerns of I&APs	C	A	A	A	D	C	A	86 (6)	57 (4)	14 (1)	0
2.3.3 Key impacts	C	A	A	A	D	C	B	86 (6)	57 (4)	14 (1)	0
2.4 Prediction of impact magnitude	D	A	A	A	C	C	A	86 (6)	57 (4)	14 (1)	0
2.4.1 Data to estimate magnitude of main impacts	D	B	A	B	C	C	B	86 (6)	57 (4)	14 (1)	0
2.4.2 Methods used to predict impact magnitude	D	A	A	A	C	B	A	86 (6)	71 (5)	14 (1)	0
2.4.3 Predictions of impact in measurable quantities	D	A	A	A	C	C	A	86 (6)	57 (4)	14 (1)	0
2.5 Assessment of impact significance	C	A	A	B	B	B	C	100(7)	71 (5)	0	0
2.5.1 Significance of impact on affected community and society in general	C	B	A	C	B	C	D	86 (6)	43 (3)	14 (1)	0
2.5.2 Significance of national and international quality standards	C	A	A	A	B	A	B	100(7)	86 (6)	0	0
2.5.3 Justification of proposed methods of assessing significance	C	A	B	A	B	A	A	100(7)	86 (6)	0	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.2.2.3 Review Area 3 – Alternatives and Mitigation (2014 regime)

Five reports (71%) were graded satisfactory (A-C), of which four reports (57%) were graded excellent (A – B) and two reports (29%) were graded unsatisfactory. Alternatives was graded 2As, 1B, 1C and 3Ds, Scope and effectiveness of mitigation measures was graded 3As, 2Bs, 2Ds and Commitment to mitigation was graded 3As, 1B, 3Cs. Four reports (57%) were graded D -F for sub-category 3.1.2, which was identified as a weakness.

Table 4-10: Summary of RA 3 for the 2014 EIA regime [n= 7]

Summary of all review areas, categories and sub-categories	TAE	VBG	WDM	WCW	EEG	BMN	CRK	% A-C	% A-B	%D-F	% E-F
3 Alternatives and mitigation	D	A	B	A	C	D	B	71 (5)	57 (4)	29 (2)	0
3.1 Alternatives	D	A	C	A	D	D	B	57 (4)	43 (3)	43 (3)	0
3.1.1 Description of alternative sites	D	A	C	A	D	D	A	57 (4)	43(3)	47 (3)	0
3.1.2 Description of alternative processes, design and operating conditions	D	A	D	A	D	D	B	43 (3)	43 (3)	57 (4)	0
3.1.3 For severe adverse impacts rejected alternative identified	D	B	C	A	D	D	C	57 (4)	29 (2)	43 (3)	0
3.1.4 Comparative assessment of all alternatives identified	E	A	B	A	D	D	A	57 (4)	57 (4)	43 (3)	14 (1)
3.2 Scope and effectiveness of mitigation measures	D	A	A	A	B	D	B	71 (5)	71 (5)	29 (2)	0
3.2.1 Consider mitigation of all significant adverse impacts	D	A	A	A	B	C	B	86 (6)	71 (5)	14 (1)	0
3.2.2 Mitigation measures	D	A	A	A	B	C	B	86 (6)	71 (5)	14 (1)	0
3.2.3 Extent of effectiveness of mitigation when implemented	D	A	A	A	B	C	C	86 (6)	57 (4)	14 (1)	0
3.3 Commitment of mitigation	C	A	A	A	C	C	B	100(7)	57 (4)	0	0
3.3.1 Record of commitment to mitigation measures	C	A	A	A	C	C	A	100(7)	57 (4)	0	0
3.3.2 Monitoring arrangements	C	A	A	A	C	C	B	100(7)	57 (4)	0	0

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

4.2.2.4 Review Area 4 – Communication of results (2014 regime)

Four reports (57%) were graded as satisfactory (A-C) and the four reports (57%) were graded as excellent (A-B). Two (29%) were graded unsatisfactory (D-F). Report layout received 3As, 1B, 1C

and 2Ds, presentation received 4As, 1B, 2Ds, emphasis received 2As, 2Bs,2Cs and 1D and non – technical summary 1A, 3Bs, 2Cs and 1F.

As indicated in Table 4-11 below, RA 4 for the 2014 EIA regime had no strengths or weaknesses according to the criteria explained above.

Table 4-11: Summary of Review Area 4 for the 2014 EIA regime [n= 7]

Summary of all review areas, categories and sub-categories	TAE	VBG	WDM	WCW	EEG	BMN	CRK	% A-C	% A-B	% D-F	% E-F
4 Presentation and Communication	D	A	A	A	D	C	B	71 (5)	57 (4)	29 (2)	0
4.1 Layout of the report	D	A	A	A	D	C	B	71 (5)	57 (4)	29 (2)	0
4.1.1 Introduction	D	A	A	A	E	C	C	71 (5)	43 (3)	29 (2)	14 (1)
4.1.2 Information logically arranged	D	A	A	A	C	B	A	86 (6)	71 (5)	14 (1)	0
4.1.3 Chapter summaries	D	A	B	A	D	C	A	71 (5)	57 (4)	29 (2)	0
4.1.4 External sources acknowledged	D	A	A	A	C	C	A	86 (6)	57 (4)	14 (1)	0
4.2 Presentation	D	A	A	A	D	B	A	71 (5)	71 (5)	29 (2)	0
4.2.1 Presentation of information	D	A	A	A	C	B	A	86 (6)	71 (5)	14 (1)	0
4.2.2 Technical terms, acronyms, initials defined	C	A	A	A	F	B	A	86 (6)	71 (5)	14 (1)	14 (1)
4.2.3 Statement presented as an integrated whole	D	A	A	A	D	B	A	71 (5)	71 (5)	29 (2)	0
4.3 Emphasis	D	A	A	B	C	C	B	86 (6)	57 (4)	14 (1)	0
4.3.1 Emphasis to potentially severe impacts	D	A	A	B	C	C	B	86 (6)	57 (4)	14 (1)	0
4.3.2 Statement must be unbiased	C	A	A	A	C	C	B	100 (7)	57 (4)	0	0
4.3.3 Opinion as to whether activity should/should not be authorized	D	A	A	A	C	D	A	71 (5)	57(4)	29 (2)	0
4.4 Non- technical summary	C	B	B	A	F	C	B	86 (6)	57 (4)	14 (1)	14 (1)
4.4.1 Non-technical summary of main findings & conclusions	C	B	B	A	F	C	B	86 (6)	57 (4)	14 (1)	14 (1)
4.4.2 Summary must cover all main issues	C	B	C	A	F	C	B	86 (6)	43 (3)	14 (1)	14 (1)

Level of quality	Good	Marginally satisfactory	Marginally unsatisfactory	Weak/poor
Grade and colour	A-B	C	D	E-F

Reports VBG, WDM, WCW, EEG, BMW and CRK performed well, with WCW identified as the strongest project, with many A-B grades, while TAE was identified as having the weakest project performance with many D grades. The findings are discussed below.

4.3 Findings

Table 4-12 below contains a summary of the overall grades, review areas and categories for both the NEMA 2010 and NEMA 2014 EIA regimes. For both the 2010 and 2014 regimes, six reports (86%) were graded satisfactory (A-C) and one report (14%) was graded unsatisfactory (D-F). For the 2010 regime, four reports (57%) were graded as excellent (A – B) while only three reports (43%) from the 2014 EIA regime were graded as excellent. Neither regime had any reports graded E-F.

Each EIA regime had its own strengths and weaknesses. Communication of results (RA 4), with 71%, and the description of the project and the environment (RA 1), with 57% showed a strength for the NEMA 2010 EIA regime. Impact identification (RA 2), with 43%, and Alternatives and mitigation (RA 3) with 29% showed a weakness. The NEMA 2014 EIA regime had a consistency of 57% in all four review areas. It is evident in the table below that there is more green (86% and above of grade A-B), but also more gold (14% graded E-F) in the 2010 regime whereas the 2014 regime has less gold (14% graded E-F).

Table 4-12: Summary of the overall Review Areas and category grades for the 2010 and 2014 EIA regime

Hazardous Waste Treatment Facilities EIARs [n= 14]									
		2010 EIA regime				2014 EIA regime			
Summary of all review areas, categories and sub-categories		**% A-C**	**% A-B**	**%D-F**	**% E-F**	**% A-C**	**% A-B**	**%D-F**	**% E-F**
Overall grade		**86 (6)**	**57 (4)**	**14 (1)**	**0**	**86 (6)**	**43 (3)**	**14 (1)**	**0**
RA 1	Description of project and environment	100 (7)	57 (4)	0	0	100 (7)	57 (4)	0	0
1.1	Description of the development	100 (7)	100 (7)	0	0	100 (7)	57 (4)	0	0
1.2	Site description	71 (5)	14 (1)	29 (2)	0	57 (4)	29 (2)	43 (3)	0
1.3	Waste	100 (7)	43 (3)	0	0	100 (7)	71 (5)	0	0
1.4	Environmental description	86 (6)	71 (5)	14 (1)	0	86 (6)	43 (3)	14 (1)	0
1.5	Baseline conditions	71 (5)	43 (3)	14 (1)	0	86 (6)	43 (3)	14 (1)	0
RA 2	Impact identification and evaluation	86 (6)	43 (3)	14 (1)	0	100 (7)	57 (4)	0	0
2.1	Definition of impacts	86 (6)	43 (3)	14 (1)	0	71 (5)	43 (3)	29 (2)	0
2.2	Identification of impacts	71 (5)	43 (3)	29 (2)	29 (2)	100 (7)	71 (5)	0	0
2.3	Scoping	100 (7)	86 (6)	0	0	100 (7)	57 (4)	0	0
2.4	Prediction of impact magnitude	71 (5)	43 (3)	29 (2)	0	86 (6)	57 (4)	14 (1)	0
2.5	Assessment of impact significance	86 (6)	86 (6)	14 (1)	14 (1)	100 (7)	71 (5)	0	0
RA 3	Alternatives and mitigation	86 (6)	29 (2)	14 (1)	14 (1)	71 (5)	57 (4)	29 (2)	0
3.1	Alternatives	71 (5)	14 (1)	29 (2)	0	57 (4)	43 (3)	43 (3)	0
3.2	Scope and effectiveness of mitigation measures	86 (6)	71 (5)	14 (1)	14 (1)	71 (5)	71 (5)	29 (2)	0
3.3	Commitment of mitigation	86 (6)	71 (5)	14 (1)	0	100 (7)	57 (4)	0	0
RA 4	Communication of results	86 (6)	71 (5)	14 (1)	0	57 (4)	57 (4)	29 (2)	0
4.1	Layout of the report	71 (5)	71 (5)	29 (2)	14 (1)	57 (4)	57 (4)	29 (2)	0
4.2	Presentation	86 (6)	86 (6)	14 (1)	0	71 (5)	71 (5)	29 (2)	0
4.3	Emphasis	86 (6)	86 (6)	14 (1)	0	57 (4)	57 (4)	14 (1)	0
4.4	Non-technical summary	86 (6)	86 (6)	14 (1)	0	86 (6)	57 (4)	14 (1)	14 (1)

Level of quality	Excellent	Satisfactory	Just unsatisfactory	Weakness	Unsatisfactory
Grade and colour	Dark green	Light green	Orange	Red	Gold

4.4 Discussion

The review of the quality of EIARs for hazardous waste treatment facilities showed similar results to previous research on the quality of EIARs, in which the quality was graded as satisfactory, both nationally and internationally (Barker & Wood, 1999; Mbhele,2009; Sandham *et al*.,2013; Thorpe, 2014; Sebetlele,2018; Ceronio, 2019; Sandham *et al*.,2020; Botha,2022). RA 4 (Communication of results) performed well under the 2010 regime at 71%, while all four RAs performed satisfactorily under the 2014 regime, with 57% (A-C) grades. The NEMA 2010 results showed that RA 2 and 3 had lower scores, while RA 1 and 4 had higher scores.

The two regimes (2010 and 2014) are now compared to indicate the changes.

RA 1 (Description of the development and environment) showed no improvement and remained the same, with seven reports (100%) graded A-C and four reports (57%) graded A-B with no reports graded D-F and E-F for either the 2010 or 2014 regimes. However, Waste (1.3) showed an improvement with three reports (43%) being graded A-B in the 2010 regime and five reports (71%) graded A-B in the 2014 regime.

RA 2 (Impact identification and evaluation) showed an improvement, from six reports (86%) graded A-C, three reports (43%) graded A-B, one report (14%) graded D-F and no reports graded E-F for the 2010 regime to seven reports (100%) graded A-C, four reports (57%) graded A-B and no reports graded D-F and E-F for the 2014 regime. The review area improved with only one

weakness area identified. Impact from non-standard operating procedure (2.1.3) improved from four reports (57%) to two reports (29%) being graded E-F. Category 2.2 and sub-categories 2.1.4, 2.2.2 and 2.4.3, which had been identified as areas of weakness in the 2010 regime, had no reports graded E-F in the 2014 regime.

Six reports (86%) for RA 3 (Alternatives and mitigation) were graded A-C and one report (14%) was graded D-F for the 2010 regime, and five reports (71%) were graded A-C and two reports (29%) were graded D-F for the 2014 regime. However, the RA showed an improvement, from two reports (29%) being graded A-B and one report (14%) being graded E-F for the 2010 regime to four reports (57%) being graded A-B and no reports graded E-F for the 2014 regime. Record of commitment to mitigation measures (3.3.1) showed a decline, with six reports (86%) being graded A-B for the 2010 regime to four reports (57%) being graded A-B in the 2014 regime. However, it showed an improvement, with six reports (86%) being graded A-C for the 2010 regime to seven reports (100%) graded A-C for the 2014 regime. The RA also showed an improvement, with only one category graded E-F for the 2014 regime as compared to the two categories from the 2010 regime.

RA 4 (Communication of results) showed a decline, with six reports (86%) being graded A-C and five reports (71%) being graded A-B for the 2010 regime to four reports (57%) being graded A-C and A-B for the 2014 regime. Categories 4.2 (Presentation) and 4.3 (Emphasis), sub-categories 4.1.2 (Information logically arranged), 4.2.1 (Presentation of information), 4.2.2 (Technical terms, acronyms, initials defined), 4.2.3 (Statement presented as an integral whole) all showed a decline, from six reports (86%) and sub-category 4.3.3 (opinion as to whether activity should/should not be authorised) from seven reports (100%) being graded A-B for the 2010 regime to five reports (71%) graded A-B for the 2014 regime.

Twelve reports (86%) were of a generally satisfactory quality with A-C grades, while two reports, CHK and TAE (14%) performed poorly throughout, with many D and E-F grades, yet the proposed developments were authorised. This indicates that the quality of the EIA was not considered and, therefore, its contribution to decision-making was compromised. This is of concern since hazardous waste needs to be managed efficiently.

Thorpe (2014) found that overall, 75% of the scoping reports were satisfactory, 25% were unsatisfactory and 10% were poorly attempted. Areas of strengths included stakeholder engagement, identification of the EAP and expertise and experience, communication of results and areas of weakness include poor consideration of alternatives, poor consideration, and identification of raw materials. Ceronio (2019) found that the quality was satisfactory with 60% being graded as excellent, 20% generally satisfactory and 20% being just satisfactory.

Sandham *et al*. (2020) found that 92% of the results were satisfactory and 8% just satisfactory. The results indicate that the quality of EIARs across the four review areas is good and there was improvement across the three regimes (ECA 1997, NEMA 2006/10 and 2014/17) However, the results highlighted weaknesses in dealing with waste and, to a lesser extent dealing with significance and mitigation.

4.5 Chapter summary

This chapter consisted of an analysis and discussed the results of the quality review of 14 EIARs from the NEMA 2010 and NEMA 2014 EIA regimes. Objective two of the dissertation was achieved. The results showed that the quality of EIARs were satisfactory. RA 2 and 3 showed improvement, RA 1 remained the same and RA 4 showed a decline. There was an overall improvement for the 2014 EIA regime as compared to the 2010 EIA regime, with fewer D-F grades in some categories. The next chapter (Chapter 5) comprises the conclusion and recommendations of the study.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

This chapter comprises a presentation of the conclusion of the dissertation. It includes a summary the literature review of studies on EIA from its origin, purpose and practices, both internationally and nationally. Furthermore, the achievement of the main aim and objectives are noted, the main findings are indicated, and recommendations for further research are presented.

5.1 Introduction

An EIA is an assessment of the identified potential environmental impacts of a proposed development. It is an environmental tool that is used both internationally and nationally. EIA originated in 1960 in the USA. It has since come to be considered one of the most successful policy interventions with respect to environmental protection and has been adopted in many countries (Kidd et al., 2018). South Africa has a long history of EIA. They were conducted voluntarily from the 1970s and enforced in 1997 when, EIA regulations were gazetted by the government (Sowman *et al*.,1995; South Africa, 2004). There have since been several EIA regimes, from the ECA regime in 1997 to the NEMA regime of 2017. EIA is conducted according to step-by-step process, which includes screening, scoping, public consultation, consideration of alternatives and mitigation, and the assessment of impacts and their significance, as well as follow up actions, all of which are reflected in the EIAR.

The Waste Act, 59 of 2008 (South Africa, 2008) provides for an EIA licensing regime specific to waste management activities. Proposed waste developments or projects that require certain listed waste activities are required to conduct an EIA and produce an EIAR to inform decision making.

Effectiveness has been a particular concern in the EIA research and practice community. One of the factors that determines the effectiveness of EIA is the quality of the EIAR, which is used by the CAs for decision making. Therefore, their quality is of immense importance (Sandham & Pretorius, 2008; Sandham *et al*., 2013; Sandham *et al*., 2020)

The literature revealed that research on the quality of EIARs for waste management facilities in South Africa was limited and that there was, therefore, a gap in the literature and, thus, a need for further research to be conducted. In particular, no research had been done to ascertain whether any progress had been made since the end of the 2010 regime and under the 2014 regime, and previous studies were limited in scope.

5.2 Dissertation Chapters

The dissertation contains five chapters. Chapter 1 is an introductory chapter in which the problem statement, research question, aim and objectives are presented. Chapter 2 comprises the literature review of EIA, both internationally and nationally. Chapter 3 contains a description of the study

area, the sample of EIARs selected for the two EIA regimes and the method used for the review. Chapter 4 comprises the presentation and analysis of the results.

5.3 Research aim and objectives

The broad aim of this study was to determine the quality of EIARs for hazardous waste treatment facilities in South Africa. The following objectives were formulated.

1. To review the quality of selected EIARs for hazardous waste treatment facilities for the NEMA 2010 and 2014 EIA regimes using the adapted Lee and Colley review package.
2. To analyse, compare and interpret the results that were obtained from the review.
3. To identify the strengths and weaknesses of the EIA reports.

5.3.1 Objective 1 – To review the quality of selected EIARs for hazardous waste treatment facilities for the NEMA 2010 and 2014 EIA regime using the adapted Lee and Colley review package.

In order to achieve this objective, the quality of 14 selected EIARs for hazardous waste facilities for the NEMA 2010 and 2014 EIA regimes were reviewed. The EIARs were reviewed using the adapted Lee and Colley review package. Seven EIARs were selected from the NEMA 2010 EIA regime and seven EIARs from the NEMA 2014 EIA regime. All the EIARs related to projects that had already been finalised. Data were collected from the national Department of Forestry, Fisheries and the Environment, which is the competent authority responsible for hazardous waste.

5.3.2 Objective 2 – To analyse, compare and interpret the results that were obtained from the review.

The results were analysed and interpreted. EIARs with symbols A-C were regarded as satisfactory and D – F as unsatisfactory. 12 reports were graded satisfactory with good grades, and two reports were graded unsatisfactory with poor grades.

For the NEMA 2010 EIA regime, communication of results performed very well, description of the development and environment was satisfactory while impact identification and evaluation and the alternatives and mitigation scored low. The results showed a similar trend to other studies conducted on the quality of EIARs in South Africa where Impact identification and evaluation and Alternatives and mitigation had low scores (Mbhele,2009; Sandham *et al*.,2013; Sebetlele,2018; Sandham *et al*.,2020; Botha, 2022). For the NEMA 2014 EIA regime all four areas were satisfactory.

5.3.3 Objective 3 - To identify the strengths and weaknesses of the EIARs

The strengths and weaknesses of the EIARs were identified with a view to improving EIA practice for hazardous waste facilities. The strengths were regarded as anything above 86% A-B grades and the weakness as 57% and above E-F grades.

The general areas of strengths were:

- Description of the development.
- Identification of the EAP.
- Details of the EAP.
- Stakeholder engagement.
- Impacts identification methodology.
- Communication of results.

The general areas of weakness were:

- Duration of the different phases.
- Estimated number of workers and or visitors.
- Impact from non-standard operating procedure.
- Comparative assessment of all alternatives identified.
- Acknowledgement of external sources.

Changes in performance were seen in the categories and sub-categories between the 2010 and 2014 regimes. There was not much improvement in the 2014 regime in relation to the strengths. However, there was improvement in areas that performed poorly in the 2010 regime. There was an immense improvement in terms of areas of weakness. The 2014 regime had very few grades E-F.

5.4 Conclusion

It is concluded that the quality of EIARs for hazardous waste treatment facilities in South Africa is generally satisfactory with many reports performing well and a few unsatisfactory. It conforms to the study of Thorpe (2014) which found that the quality was satisfactory with some reports being unsatisfactory and a few poorly attempted and that of Ceronio (2019) which found that the overall quality was satisfactory with many of the reports performing well and a few just satisfactory.

It is also evident that there has been an improvement under the NEMA 2014 EIA regime as compared to the 2010 regime and suggests that EAPs have improved in meeting the EIA minimum requirements and best practice. The 2014 EIARs were satisfactory in all the review areas and showed an improvement in impact “identification and evaluation”, and “alternatives and mitigation” although a decrease was found in “communication of results”. These results are similar to those of

Sandham *et al.* (2020) where the quality of EIARs in South African national parks were evaluated and found that there was improvement throughout the three regimes. Improvement in the quality of EIARs for hazardous waste treatment facilities is required for better decision making and best practice, especially in the areas of weakness.

5.5 Recommendation

It is recommended that EAPs improve in the RA "communication of results" and in the acknowledgement of external sources, comparative assessment of all alternatives identified, impacts from non-standard operating procedure and the estimated number of workers and visitors. The improvement could result in better and informed decision making. It is further recommended that research be conducted on the quality of EIARs for more hazardous waste treatment facilities in South Africa. It is suggested that the researchers use a larger sample and include waste activities that were not investigated in this study, such as waste disposal, and recycling facilities.

5.6. Contribution of this study

This study contributes to the field of knowledge of EIARs for hazardous waste management by filling a gap in the literature, namely that previous studies have not covered the period under the 2014 regime and, thus, not noted whether any progress had been made in the quality of EIA reporting. The findings of this study will be of use to decision-makers, such as DFFE because they pinpoint problematic areas that need to be attended to as well as indicating areas of success. EAPS will also benefit by being made aware of areas on which they need to improve.

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APPENDIX A: The adapted Lee and Colley review package used for the evaluation of EIARs for hazardous waste treatment facilities in South Africa.

The package was adapted by Van Heerden (2010).

SA guidelines added/altered are in italic.

1. DESCRIPTION OF THE DEVELOPMENT, LOCAL ENVIRONMENT AND BASELINE CONDITIONS.

1.1 Description of the development: the purpose(s) of the development should be described as should the physical characteristics, scale and design. Quantities of materials needed during construction and operation should be included, and where appropriate, a description of the production processes.

1.1.1 The purpose(s) and objectives of the development should be explained, *as well as the need and desirability.*

1.1.2 The design and size of the development should be described. Diagrams, plans or maps will be necessary for this purpose.

1.1.3 There should be some indication of the physical presence and appearance of the completed development within the receiving environment.

1.1.4 Where appropriate, the nature of the production processes intended to be employed in the completed development should be described and the expected rate of production.

1.1.5 The nature and quantities of raw materials needed during both the construction and operational phases should be described.

1.1.6 *Identification of applicant, including name, address and contact numbers.*

1.1.7 *Details of EAP to carry out environmental impact assessment, including declaration of independence and expertise of EAP.*

1.2 Site description: On site land requirements of development and duration of each land use

1.2.1 The land area taken up by the development site should be defined and its location clearly shown on a map.

1.2.2 The uses to which this land will be put should be described and the different land use areas demarcated.

1.2.3 The estimated duration of the construction phase, operational phase and, where appropriate, decommissioning phase should be given.

1.2.4 The numbers of workers and/or visitors entering the development site during both construction and operation should be estimated. Their access to the site and likely means of transport should be given.

1.2.5 The means of transporting raw materials and products to and from the site and the approximate quantities involved should be described.

1.3 Wastes: Estimated types and quantities of wastes which might be produced and proposed disposal routes to the environment described

[Wastes include all residual process materials, effluents and emissions, waste energy, waste heat, noise etc]

1.3.1 The types and quantities of waste matter, energy and other residual materials, and the rate at which these will be produced should be estimated.

1.3.2 The ways in which it is proposed to handle and/or treat these wastes and residual should be indicated, together with the routes by which they will eventually be disposed of to the environment.

1.3.3 The methods by which the quantities of residuals and wastes were obtained should be indicated. If there is uncertainty this should be acknowledged, and ranges of confidence limits given where possible.

1.4 Environment description: Area and location likely to be affected by development proposal

1.4.1 The environment expected to be affected by the development should be indicated with the aid of a suitable map of the area.

1.4.2 The affected environment should be defined broadly enough to include any potentially significant effects occurring away from the immediate construction site. These may be caused by the dispersion of pollutants, infrastructural requirements of the project, traffic, etc.

1.5 Baseline conditions: Description of effected environment as it is currently, and as it could be expected to develop if project were not to be proceed

1.5.1 The important components of the affected environments should be identified and described. The methods and investigations undertaken for this purpose should be

disclosed and should be appropriate to the size and complexity of the assessment task. Uncertainty should be indicated.

1.5.2 Existing data sources should have been searched and where relevant utilized, including local authority records and studies carried out by, or on behalf of, conservation agencies and/or special interest groups.

1.5.3 Local land use plans and policies should be consulted and other data collected as necessary to assist in the determination of the "baseline" conditions, i.e. the probable future state of the environment, in the absence of the project, taking into account natural fluctuations and human activities.

2. IDENTIFICATION AND EVALUATION OF KEY IMPACTS

2.1 Definition of impacts: Potential impacts of development on the environment should be investigated and described. Impacts should be broadly defined to cover all potential effects on the environment and should be determined as the predicted deviation from the baseline state.

2.1.1 A description of the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project should be given.

2.1.2 The above types of effect should be investigated and described with particular regard to identifying effects on or affecting human beings, flora and fauna, soil, water, air, climate, landscape, material assets, cultural heritage (including architectural and archaeological heritage) and the interactions between them.

2.1.3 Consideration should not be limited to events which will occur under design operating conditions. Where appropriate, impacts which might arise from non-standard conditions or due to accidents should be described.

2.1.4 The impacts should be determined as the deviation from baseline conditions, i.e. the difference between the conditions which would obtain if the development were not to proceed and those predicted to prevail as a consequence of it.

2.2 Identification of impacts: Methods used for identification of all significant impacts

2.2.1 Impacts should be identified using a systematic methodology such as project specific checklists, matrices, panels of experts, consultations, etc. Supplementary methods (e.g. cause-effect or network analyses) may be needed to identify secondary impacts.

2.2.2 A brief description of the impact identification methods should be given as should the rational for using them.

2.3 Scoping: Key impacts should be identified, taking into account the views of interested parties, and main investigation centered on these.

2.3.1 There should be a genuine attempt to contact the general public and special interest groups to appraise them of the project and its implications, *including a description of the advertisement, notification in the relevant provincial gazette, newspaper (local, regional, national) on site advertisement, advertisement of public meeting and notification of availability of EIAR.*

2.3.2 Arrangements should be made to collect the opinions and concerns of relevant public agencies, special interest groups and general public. Public meetings, seminars, discussing groups, etc. may be arranged to facilitate this. *Steps undertaken must be in accordance with plan of study*. *Included must be a list of registered I&AP's, summary of comments received, summary of issues raised, date of receipt of comments, response of EAP and copies of any representations, objections and comments received from registered I&APs.*

2.3.3 Key impacts should be identified and selected for more intense investigation. Impact areas not selected for thorough study should be identified and the reasons why they require less detailed investigation be given.

2.4 Prediction of impact magnitude: Likely impacts should be described in exact terms where possible

2.4.1 The data used to estimate the magnitude of the main impacts should be sufficient for the task and should be clearly described or their sources clearly identified. Any gaps in the required data should be indicated and the means used to deal with them in the assessment be explained.

2.4.2 The methods used to predict impact magnitude should be described and be appropriate to the size and importance of the projected impacts.

2.4.3 Where possible should predictions of impacts be expressed in measurable quantities with ranges and/or appropriate confidence limits. Qualitative descriptions, where these are used, should be fully defined.

2.5 Assessment of impact significance: Estimation of expected significance of impacts for society. The sources of quality standards, together with the rationale,

assumptions and value judgements used in assessing significance should be described.

2.5.1 The significance to the affected community and society in general should be described and clearly distinguished from impact magnitude. Where mitigation measures are proposed *an indication must be given of the degree to which the impact can be mitigated, reversed or to which the impact may cause irreplaceable loss of resources.* The significance of any impact remaining after mitigation should also be described.

2.5.2 The significance of an impact should be assessed taking into account appropriate national and international quality standards where available. Account should also be taken of the magnitude, location and duration of the impact in conjunction with national and local societal values.

2.5.3 The choice of standards, assumptions and value systems used to assess significance should be justified and any contrary opinions should be summarized.

3. ALTERNATIVES AND MITIGATION

3.1 Alternatives: Feasible alternatives should be considered. These should be outlined, the environmental implications of each presented and the reasons for their rejection briefly discussed, particularly where the preferred project is likely to have significant adverse environmental impacts.

3.1.1 Alternative sites should be considered where these are practicable and available to the developer. The main environmental advantages and disadvantages of these should be discussed and the reasons for the final choice given.

3.1.2 where available, alternative processes, designs and operating conditions should be considered and the environmental implications of these investigated and reported where the proposed project is likely to have significant adverse environmental impacts.

3.1.3 If unexpectedly severe adverse impacts are identified during the course of the investigation, which are difficult to mitigate, alternatives rejected in the earlier planning phases should be re-appraised.

3.2 Scope and effectiveness of mitigation measures: All significant adverse impacts should be considered for mitigation. Evidence should be presented to show that proposed mitigation measures will be effective when implemented.

3.2.1 The mitigation of all significant adverse impacts should be considered and where practicable, specific mitigation measures should be put forward. Any residual or unmitigated impacts should be indicated and justified.

3.2.2 Mitigation methods considered should include modification of the project, compensation and the provision of alternative facilities as well as pollution control.

3.2.3 It should be clear to what extent the mitigation methods will be effective when implemented. Where the effectiveness is uncertain or depends on assumptions about operating procedures, climatic conditions, etc. data should be introduce to justify the acceptance of these assumptions.

3.3 Commitment to mitigation: Developers should be committed to and capable of carrying out the mitigation measures and should present plans of how they proposed to do so.

3.3.1 There should be a clear record of the commitment of the developer to the mitigation measures presented in the EIAR. Details of how the mitigation measure will be implemented and function over the time span for which they are necessary should be given. *The draft EMP must comply with regulations and must include specific information required by the competent authority.*

3.3.2 Monitoring arrangements should be proposed to check the environmental impacts resulting from the implementation of the project and their conformity with the predictions within the EIAR. Provision should be made to adjust mitigation measures where unexpected adverse impacts occur. The scale of the monitoring arrangements should correspond to the likely scale and significance of deviations from expected impacts.

4. COMMUNICATION OF RESULTS

4.1 Layout of the report: the layout should enable the reader to find and assimilate data easily and quickly. External data sources should be acknowledged.

4.1.1 There should be an introduction briefly describing the project, the aims of the environmental assessment and how the aims are to be achieved.

4.1.2 Information should be logically arranged in sections or chapters and the whereabouts of important data be signaled in a table of contents or index.

4.1.3 Unless the chapters are very short, there should be chapter summaries outlining the main findings of each phase of the investigation.

4.1.4 Where data, conclusions or quality standards from external sources are introduced, the original source should be acknowledged at that point in the text. A full reference should be included either with the acknowledgement, at the bottom of the page or in a list of references.

4.2 Presentation: Presentation of the information should be accessible to the non-specialist

4.2.1 Information should be comprehensible to the non-specialist. Tables, graphs and other devices should be used as appropriate. Unnecessarily technical or obscure language should be avoided.

4.2.2 Technical terms, acronyms and initials should be defined, either when first introduced into the text or in a glossary. Important data should be presented and discussed in the main text.

4.2.3 The EIAR should be presented as an integrated whole. Summaries of data presented in separately bound appendices should be introduced in the main body of the text.

4.3 Emphasis: Information should be represented without bias and receive the emphasis appropriate to its importance in the context of the assessment.

4.3.1 Emphasis should be given to potentially severe adverse, as well as potentially substantial favorable environmental impacts.

4.3.2 The report should be unbiased. It should not lobby for any particular point of view. Adverse impacts should not be disguised by euphemisms or platitudes.

4.3.3 *Opinion as to whether the activity should/should not be authorized.*

4.4 Non-technical summary: Clearly written non-technical summary of main findings

4.4.1 There should be a non-technical summary of the main findings and conclusion of the study. Technical terms, lists of data and detailed explanations of scientific reasoning should be avoided.

4.4.2 The summary should cover all main issues discussed, a brief description of the project and the environment, an account of the main mitigation measures to be undertaken, and any significant residual impacts. A brief explanation of the methods by which these data were obtained and an indication of the confidence which can be place in them should be included.

APPENDIX B: Adapted Collation Sheet

EIAR:_____

Overall Assessment:_____

1.____	**2**.____	**3**.____	**4**.____
1.1 ____	**2.1**____	**3.1**____	**4.1**____
1.1.1____	2.1.1____	3.1.1____	4.1.1____
1.1.2____	2.1.2____	3.1.2____	4.1.2____
1.1.3____	2.1.3____	3.1.3____	4.1.3____
1.1.4____	2.1.4____	3.1.4____	4.1.4____
1.1.5____			
1.1.6____	**2.2**____	**3.2**____	**4.2**____
1.1.7____	2.2.1____	3.2.1____	4.2.1____
	2.2.2____	3.2.2____	4.2.2____
1.2____		3.2.3____	4.2.3____
1.2.1____	**2.3**____		
1.2.2____	2.3.1____	**3.3**____	**4.3**____
1.2.3____	2.3.2____	3.3.1____	4.3.1____
1.2.4____	2.3.3____	3.3.2____	4.3.2____
1.2.5____			4.3.3____
	2.4____		
1.3____	2.4.1____		**4.4**____
1.3.1____	2.4.2____		4.4.1____
1.3.2____	2.4.3____		4.4.2____
1.3.3____			
	2.5____		
1.4____	2.5.1____		
1.4.1____	2.5.2____		
1.4.2____	2.5.3____		
1.5____			
1.5.1____			
1.5.2____			
1.5.3____			

APPENDIX C: Raw Data

NO	EIA NEMA Regime	NEMA 2010							NEMA 2014						
	Report short name	**LPL**	**WRN**	**KKN**	**MPA**	**CHK**	**LWC**	**CWK**	**TAE**	**VBG**	**WDM**	**WCW**	**EEG**	**BMN**	**CRK**
	Overall Grade	**B**	**B**	**C**	**C**	**D**	**B**	**B**	**D**	**A**	**A**	**A**	**C**	**C**	**C**
1	**DESCRIPTION OF ENVIRONMENT**	**B**	**B**	**C**	**C**	**C**	**B**	**B**	**C**	**A**	**A**	**A**	**C**	**C**	**B**
1.1	Description of the development	**B**	**A**	**B**	**B**	**B**	**B**	**B**	**C**	**A**	**A**	**A**	**C**	**C**	**B**
1.1.1	Purpose and objectives	A	A	A	A	C	B	A	C	A	A	A	E	C	C
1.1.2	Design and size	B	C	A	A	A	C	A	C	A	A	A	D	C	A
1.1.3	Presence and appearance of completed development	C	B	A	C	C	C	B	C	B	A	B	D	C	C
1.1.4	Nature of production processes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1.1.5	Nature of quantity of raw materials	C	F	C	D	E	D	D	E	B	A	B	D	D	C
1.1.6	Identification of applicant	A	A	A	A	A	A	A	A	A	A	A	B	C	B
1.1.7	Details of EAP	A	A	A	A	C	A	A	A	A	A	A	A	A	A
1.2	**Site description**	**B**	**C**	**D**	**C**	**D**	**C**	**C**	**D**	**C**	**B**	**B**	**D**	**D**	**C**
1.2.1	Area of development site	A	B	C	C	A	C	A	B	A	A	A	C	C	A
1.2.2	Demarcation of land use area	A	B	D	C	D	B	A	D	A	A	B	D	B	A
1.2.3	Duration of phases	A	E	D	E	E	C	E	E	E	C	A	E	E	E
1.2.4	An estimated number of workers and/ visitors	A	E	D	D	E	D	E	E	E	E	E	E	E	E
1.2.5	Means of transporting raw materials/products and quantities	C	C	C	C	E	B	E	C	B	B	A	D	D	D
1.3	**Wastes**	**B**	**A**	**C**	**C**	**C**	**C**	**B**	**C**	**A**	**B**	**A**	**C**	**B**	**B**
1.3.1	Waste streams and quantities	B	A	C	C	C	C	B	C	A	A	A	C	B	B
1.3.2	Treatment, disposal and disposal routes	A	A	C	C	D	B	A	D	A	A	A	B	B	A
1.3.3	Methods of obtaining quantity of wastes	A	A	C	C	D	C	B	C	A	C	A	C	B	B
1.4	**Environment description**	**B**	**A**	**C**	**B**	**D**	**B**	**B**	**D**	**A**	**A**	**A**	**C**	**C**	**C**
1.4.1	Area to be affected by development	A	A	C	C	C	B	B	D	A	A	A	C	C	C
1.4.2	Effects occurring away from immediate affected environment	B	B	C	C	D	C	C	D	A	A	A	D	C	C
1.5	**Baseline conditions**	**A**	**A**	**D**	**C**	**E**	**B**	**C**	**D**	**A**	**A**	**A**	**C**	**C**	**C**
1.5.1	Important components of the affected environment	A	B	D	E	E	B	C	D	A	A	A	C	C	C
1.5 .2	Existing data sources	A	A	D	C	E	B	C	D	A	A	A	C	C	C
1.5.3	Local land use plans, policies consulted and other data collected.	A	A	D	C	D	B	C	D	A	A	A	C	C	C
2	**IDENTIFICATION AND EVALUATION OF KEY IMPACTS**	**B**	**B**	**C**	**C**	**D**	**C**	**B**	**C**	**A**	**A**	**A**	**C**	**C**	**B**
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