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**THE EFFECTIVE IMPLEMENTATION OF THE MINIMUM  
REQUIREMENTS AT A WASTE DISPOSAL FACILITY IN THE  
KWAZULU-NATAL PROVINCE**

Submitted by

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(i)

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30 June 2003

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Due to the strategic importance of this research it would be appreciated if the contents of this dissertation remain confidential and not be circulated for a period of ten years.

096641

Sincerely,

**A. SEWPERSHAD (MISS)**

## DECLARATION

This research has not been previously accepted for any degree and is not being currently submitted in candidature for any degree.

This dissertation is the original work of the author and has not been submitted in part, or in whole, to any other university. Where use has been made of the work of others, it has been duly acknowledged.

**SIGNATURE :** ..... *Reyeshad* .....

**DATE :** ..... *30/06/03* .....

## **For My Parents**

In memory of my Dad, **Mr Sewpershad Sahadave**, who saw and believed in my potential even before I knew I had any.

For my Mum, **Mrs Kamla Sewpershad**, who shows me her courage and strength of character every day of her life.

You are my inspiration,  
I love you both.

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## ABSTRACT

The *Minimum Requirements for Waste Disposal by Landfill* forms part of the Department of Water Affairs and Forestry's Waste Management Series that establishes a reference framework of standards for waste management in South Africa. It also facilitates the enforcement of the landfill permitting system provided for in terms of Section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989). The minimum requirements (MR) are standards by which environmentally acceptable waste disposal practices can be differentiated from unacceptable practices. The need for environmentally acceptable yet cost-effective waste disposal has become a priority in South Africa. This is because increasing population and urbanisation have resulted in growing waste generation, placing pressure on the environment. There is also an increasing awareness of environmental issues and a desire for a clean environment on the part of the public. To ensure a cleaner environment, the Department of Water Affairs and Forestry, with whom responsibility for waste disposal is currently vested, has been tasked to meet both current and future waste disposal needs. The aim of the Department is to protect the environment and the public from the impacts of bad waste disposal practices. It has been found that whilst there is sound legislation in place, many local authorities do not comply for various reasons. The Minimum Requirements will be evaluated and a case study approach and a local authority in the Kwazulu-Natal province will be selected. The research is envisaged to highlight areas of capacity/incapacity and to identify a set of resource requirements that may be required to ensure compliance at local authority level and ultimately to the legislation that promulgates it.

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# CHAPTER ONE

## INTRODUCTION

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### 1. BACKGROUND

The production of waste, an unavoidable and unwanted by-product of all man's activities is characteristic of mankind, and inevitable in modern society. The management of waste and especially its disposal is a growing problem, particularly in developing countries like South Africa. To understand the management of waste, we have to understand the legislation that governs it.

It is important to note that legislation in South Africa is complicated and intertwined, especially when it comes to laws that impact the environment. Different legislation could often be contradictory, and it must then be determined which legislation has the authority to overrule the other. In order to do this, a distinction must be made between **original or primary** legislation, and **subordinate** legislation. Also, we must know the **hierarchy** of original or primary legislation.

- **Original or primary** legislation pertains to Acts of Parliament, as well as Laws made by the nine provinces.
- **Subordinate legislation** derives its authority from primary legislation, and includes regulations, ordinances, proclamations, authorisations such as licences, general authorisations, or permits, and even policy. In other words, it is a legal instrument made in terms of a specific Act.

The **hierarchy** of authority of legislation in South Africa is as follows:

1. The Constitution
2. Parliamentary or National Legislation (Acts of Parliament)
3. Provincial Legislation
  - Laws from 1994
  - Proclamations between 1986 and 1994

- Ordinances before 1986

#### 4. Local authority Bylaws

This means that the Constitution is the only legislation that has authority over the National Environmental Management Act and the National Water Act, and these Acts will have authority over provincial laws, and so on.

Legislation can deal with the environment in the following manners:

- Exclusively (e.g. National Environmental Management Act (**hereafter will be referred to as NEMA**), Environment Conservation Act, Atmospheric Pollution Prevention Act)
- Primarily (e.g. Forest Act)
- Semi-exclusively (e.g. National Water Act)
- Incidentally (e.g. Minerals Act, Occupational Health and Safety Act)

The Water Quality Management function of the Department of Water Affairs and Forestry (**hereafter will be referred to as DWAF**), in all the Regional Offices as well as in Head Office, is mainly responsible for the administration of the following primary legislation:

- Certain aspects of the **National Water Act, 1998 (Act 36 of 1998); (hereafter will be referred to as the NWA)**
- Certain sections of the Water Act, 1956 dealing with water quality and pollution; and Section 20 of the Environment Conservation Act, 1989, (Act 73 of 1989), (**hereafter will be referred to as the ECA**).

#### **The National Water Act, 1998 (Act 36 of 1998)**

**Section 19** of the NWA deals with pollution prevention, and specifically situations where pollution of a water resource occurs or might occur as a result of activities on land. The person who owns, controls, occupies or uses the land concerned is responsible for taking measures to prevent the pollution of the water resources. If such measures are not taken, the water management institution may itself do whatever is necessary to prevent the

pollution or to remedy its effects, and to recover all reasonable costs proportionally from the persons responsible for the pollution of the resource.

These measures may include *inter alia* measures to –

- Cease, modify or control the act or process causing the pollution;
- Comply with relevant waste standard or management practice promulgated by regulation under section 27(1);
- Contain or prevent the movement of pollutants;
- Eliminate the source of the pollution; and
- Remedy the effects of the pollution.
- The specific delegations that had been issued for giving directives must be followed when dealing with these situations.

Waste Management is a broad field, which include the generation, transport, treatment and ultimate “disposal” of all types of waste and waste streams. It is evident that this field span the jurisdiction of many National Government Departments (amongst others: the Department of Environment Affairs and Tourism, the Department of National Health, DWAF, and others), and also the jurisdiction of provincial governments and local authorities. Landfilling of waste in waste disposal sites, as method for the ultimate disposal thereof, is currently the cheapest available option to manage waste. When waste or water containing waste is deposited on land, potential impacts in terms of air pollution, soil pollution and surface water pollution may arise, but the biggest threat is to the ground water component of the water resource. Because of this reason, the responsibility for some of the aspects of waste management was assigned to the **DWAF**.

### **The Environment Conservation Act, 1989, (Act 73 of 1989)**

The aspects that deal with the final disposal of waste are addressed in Part 4 of the Act deals primarily with Waste Management and Section 20 specifically.

Waste is defined in section 1 of the ECA as:

*“any matter, whether gaseous, liquid or solid, or any combination thereof, which is from time to time designated by the Minister (of Environment Affairs) by notice in the Gazette as undesirable or superfluous by-product, emission, residue or remainder of any process or activity”.* GN1986 (GG12703 of 24/8/90) identifies waste as: any matter originating from any residential, commercial or industrial area which –

*(a) is discarded by any person; or*

*(b) is accumulated and stored by any person with the purpose of eventually discarding it with or without prior treatment connected with the discarding there-of; or*

*(c) is stored by any person with the purpose of recycling, reusing or extracting a usable product from such matter, excluding –*

*(i) water used for industrial purposes or any effluent produced by or resulting from such use which is discharged in accordance with the provisions of s21(1) of the Water Act, No 54 of 1956 or on the authority of an exemption granted under s21(4) of the Water Act, 1956;*

*(ii) any matter discharged into a septic tank or french drain sewerage system and any water or effluent contemplated by s21(2) of the Water Act, 1956;*

*(iii) building rubble used for filling or levelling purposes;*

*(iv) any radioactive substance discarded in compliance with the provisions of the Nuclear Energy Act, No 92 of 1982;*

*(v) any minerals, tailings, waste-rock or slimes produced by or resulting from activities at a mine or works as defined in s1 of the Mines and Works Act, No 27 of 1956; and*

*(vi) ash produced by or resulting from activities at an undertaking for the generation of electricity under the provisions of the Electricity Act, No 41 of 1987.*

It is important to note that section 20 of the ECA extends beyond the disposal of waste on land in a conventional disposal site, since section 20(6) of the ECA states that nobody may dispose of waste except on a disposal site for which a permit has been issued in

terms of section 20(1), and also only in *such a manner, or by means of a method*, or subject to any condition, prescribed by the Minister. “Disposal site” is defined in section 1 of the ECA as “*a site used for the accumulation of waste with the purpose of disposing or treatment of such waste*“. This implies that a person treating waste for re-use or any other purpose may only do so after approval has been obtained from the Minister. Section 20 also contains subsections, of which is further explained below.

### **1. Section 20(1)**

In terms of section 20(1) of the ECA, and in terms of the definitions of “waste” and “disposal site” contained in s1 of the ECA and in Government Notice 1986 (GG12703 of 24/8/90), nobody may establish, provide or operate a waste disposal site without a Permit issued by the Minister of Water Affairs, and such Minister may:

- Issue a permit subject to the conditions he may deem necessary;
- Alter or cancel a permit or condition therein; or
- Refuse to issue a permit.

### **2. Section 20(2)**

In terms of section 20(2), an application for a permit must be completed in the format and accompanied by the information prescribed by the Minister. The Minister has prescribed the format for application in GN R1196 (GG15832 of 8/7/1994), and no permit will be issued unless the form contained in this Regulation have been properly completed and signed by the applicant. The application form itself is only the legal document containing the application, and must be accompanied by all relevant specified information, in order to be considered complete.

### **3. Section 20(3)**

This section authorises the request for additional information from an applicant. Should the Minister require any additional information to enable him to make a decision regarding an application for a permit under section 20(1), he may demand such information from an applicant in accordance with section 20(3) of the ECA. It must also be noted that the Environmental Impact Assessment (EIA). Regulations promulgated under sections 21, 22 and 26 of the ECA must be complied with when applying for a permit under section 20(1).

The procedure for applying for a waste disposal permit is described in the Minimum Requirements, which also address the classification of waste streams, and contain requirements regarding the site selection, the EIA, and the design, construction, management, monitoring and rehabilitation of different types of waste management facilities. The Minimum Requirements are used to:

- Set out minimum procedures, actions and information required from a permit applicant during the process of permitting a proposed or existing waste disposal facility in terms of s20 of the ECA;
- Provide a point of departure from which environmentally acceptable waste disposal practices can be distinguished from environmentally unacceptable practices; and
- Provide the applicable standards or specifications that must be followed in the absence of any valid motivation to the contrary.

The information required by the Minimum Requirements, is exactly what it says it is – a Minimum Requirement. Should the Water Quality Manager consider it necessary to obtain more information than that specified in the Minimum Requirements during the evaluation of a permit application, such information must be provided in terms of section 20(3). If an application is successful, a permit is issued, containing several conditions describing the types of waste which may be accepted at the site, the design, operation, management and monitoring of the site, etc. Because Minimum Requirements are not directly legally binding, some Minimum Requirements are contained in secondary legislation such as Permits.

#### **4. Section 20(6)**

Nobody may dispose of waste except on a waste disposal site for which a permit have been issued in terms of subsection (1), and also only in such a manner, or by means of a method, or subject to any condition prescribed by the Minister.

In order to issue permits under this section of the **ECA**, or to approve the disposal of a specific waste stream at a specific waste disposal site, **DWAF** must know what types of waste will be disposed of at the site. Especially for industrial waste, the precautionary approach must be followed; namely that all waste is regarded as hazardous until proven otherwise. In order to prove that waste is not hazardous, the applicant must classify his waste according to the specifications in the Minimum Requirements series of documents. These documents contain a waste classification system, which is aimed at determining the harmfulness of waste streams, with regard to both the safety and health of humans and the potential risk it poses to the environment when such waste is disposed in a waste disposal site. The potential risk posed by the waste to the environment alone, particularly the ground water resource, may be sufficient reason for it to be classified as hazardous. **DWAF** must confirm this classification in writing, before an industrial waste may be disposed on a General (municipal) landfill site. The disposal of waste classified as hazardous into a site which is not designed to accept this type of waste is regarded as pollution, and would be a contravention of permit conditions and therefore be illegal.

The **objective** of setting Minimum Requirements is to take pro-active steps to prevent the degradation of water quality and environment, and to improve the standard of waste disposal in South Africa. To ensure practical and affordable environmental protection, graded requirements are applied to different classes of landfill. The landfill class is determined from the waste type, size of operation, and potential for significant leachate generation. Where significant leachate is generated, leachate management is mandatory. Where hazardous waste is involved, the most stringent Minimum Requirements are applicable. There is an important relationship between all aspects of the landfill development process. Good landfill site selection provides for simple cost-effective design, which, provided the site preparation is correctly carried out, provides for good landfill operation. This in turn ensures the environmental acceptability of the landfill. Environmental acceptability, in its turn, often relates directly to public acceptability. Minimum Requirements are therefore set for all technical aspects of landfill development, operation and closure. They are also set for involving **Interested and Affected Parties (IAPs)** in determining site feasibility and end-use requirements. In a



spirit of co-operative governance as mandated in **NEMA**, the requirements for public participation are integrated with the Public Scoping requirements of the **Department of Environmental Affairs and Tourism's (hereafter will be referred to as DEAT)** Environmental Impact Assessment Regulations (EIAR). The Environmental Impact Assessment (EIA), together with other necessary stages in the landfill development process, forms part of the Landfill Permit System, and has to be approved by DEAT (Province). The Permit Holder is primarily and ultimately accountable for the landfill and any effect it may have on the receiving environment. However, the Permit Holder may appoint a Responsible Person, for example, a consultant or operator, to ensure that the appropriate Minimum Requirements are applied throughout the development, operation and closure of the landfill. The Responsible Person must be qualified to the satisfaction of the Department and must be capable of understanding and correctly applying the Minimum Requirements.

However, it is speculated that these requirements, derived as they are, from first world environments, are not practicably implementable in a developing environment, such as that found in RSA, and particularly in the KZN province. Consequently, this strategic goal might be flawed at the outset, because insufficient resource capabilities will be matched to what could be viewed as 'rather stringent requirements'. So, if we list the requirements, we ought to be able to establish a set of 'resource requirements' that can be applied as a set of criteria in establishing resource capacity/incapacity, at the KZN local authority/municipal level.

## **2. MOTIVATION**

The motivation to conduct this research stems from the researcher's involvement in the Department of Water Affairs and Forestry, as a Water Pollution Control Officer. This entails site inspections of waste disposal sites and landfills in particular, to ascertain whether the operators are complying with the relevant legislation, governing operation, maintenance and closure of Landfill sites. The main concern of the Department of Water Affairs and Forestry in Kwazulu-Natal, is the non-compliance with legislation of a local authority and the need to determine the reasons thereto. To ensure, that it is in the best

interests of all stakeholders, namely, the government, the local authority and all other interested and affected parties, this study will attempt to highlight the areas of non-compliance with a view to determining the resources/ alternative practices and/or recommendations that will aid in the successful implementation of the Minimum Requirements in particular and the relevant legislation in general.

### **3. VALUE**

The benefits of this study will be outlined below:

- To improve the standard of waste disposal in South Africa, specifically at local authority level.
- To aid the Department of Water Affairs and Forestry identify areas of capacity and incapacity at local authority level, in its effort to promote environmentally acceptable waste disposal at a landfill.
- To avoid both short or long term impacts or any degradation of the environment in which the landfill is operated.
- In terms of Department of Water Affairs and Forestry mandate, to prevent pollution of the surface and ground water specifically.
- To ensure that waste disposal sites comply with legislation and provide any assistance in effective operation of a waste disposal facility, which in turn aids the population and industry that it serves.

### **4. PROBLEM STATEMENT**

Are local authorities equipped with adequate resources to meet the minimum requirements in terms of waste disposal in the KZN province?

### **5. OBJECTIVES**

- To evaluate the Minimum Requirements (MR) in order to derive a schedule of resource requirements that could be inferred as necessary for the MR to be successfully implemented.

- To apply this schedule as a measurement device to a local authority in the Kwazulu-Natal province.
- To establish the extent to which it may be inferred that a local authority is able to implement the MR.
- To document and scope the nature of the shortcomings that can be anticipated to beset the successful implementation of the MR.

## 6. RESEARCH DESIGN AND METHODOLOGY

### ❖ Preamble

This study could be viewed as exploratory in nature with a view of highlighting the capacity/incapacity of a local authority in complying with the Minimum Requirements. A qualitative approach will be utilised.

### ❖ Researcher Control of Variables

In terms of the researcher's ability to manipulate variables, an **ex post facto design** method is selected. This is applicable here since the investigator has no control over the variables in the sense of being able to manipulate them, (Cooper and Schindler, 2001: 136). The researcher will only be able to report what occurred and occurs presently, at the waste disposal site. The researcher will attempt to be as objective as possible

### ❖ The Purpose of the Study

This study is envisaged to be a descriptive study, to ascertain the resource availability for a particular local authority in order to meet the Minimum Requirements for its operation.

### ❖ The Time Dimension

A longitudinal study approach will be used here. It allows the researcher to look back at the time and track any changes/events over time that could be of relevance to the proposed study. This will allow evaluation of the local authority to be more holistic in nature.

### ❖ **Method of Data Collection**

This study will be conducted using a qualitative approach and will entail selecting case study as a basis of research. A qualitative approach will ensure a holistic perspective with the aim of understanding the case study. This method is relevant in that it focuses on one case in order to study it thoroughly before conclusions are derived. All the data and information gathered is pertinent to this particular case being studied. Though conclusions can allow for inferences to be made, the cases where such generalisations are made or applied to must be similar in all respect. The advantages of a case study method include: -

- The targeted organisations, being the Department of Water Affairs and Forestry and the Local Authority and its contractors (previously the site was run by the Department of Works), are studied carefully and all the data sources between the two organisations are analysed.
- The study focuses on the operation of the landfill site by the local authority, which was allowed by the Department of Water Affairs and Forestry and excludes irrelevant information that has no benefit for this study.
- This was followed by an interrogation or communication study by collection of additional information from all the stakeholders both at national and local authority level, via personal interviews.

### ❖ **Sample**

This study's sample was chosen from the population of landfill sites in the Kwazulu-Natal province. The Umlazi Landfill site was chosen, as it is a permitted site in terms of the Environment Conservation Act, Act 73 of 1989. It also serves to highlight the local authority's resource capacity or lack thereof in order to operate the landfill. The documents analysed include the following: -

- The landfill disposal permit that was granted by the Department of Water Affairs and Forestry to the Local Authority.
- Audit reports that were done by independent consultants. (Ongoing)

**Advantages of a Case Study Approach:**

This will entail a full contextual analysis of a fewer events (Cooper and Schindler, 2001: 138), to be as focussed as possible. An emphasis on detail will provide valuable insight in evaluation; highlighting areas of capacity/incapacity on a local authority level as well as to provide a basis for further research, if necessary. For the purposes of avoiding ambiguity and generalisation, a waste disposal site (landfill in particular) will be selected of a specific class, size and type.

**Disadvantages of Qualitative approach:**

In spite of the apparent flexibility in purposeful sampling, researchers must be aware of three types of sampling error that can arise in qualitative research. The first relates to distortions caused by insufficient breadth in sampling; the second from distortions introduced by changes over time; and the third from distortions caused by lack of depth in data collection at each site (Patton, 1990).

**Advantages of Personal Interviews:**

- Enable the researcher to obtain depth and detail with regards to the collection of information.
- Enable probing if the respondent for clarification purposes.
- Assure the respondent of privacy and objectivity.
- This will also allow additional information if accompanied on site visits through observation.

**Disadvantages of Personal Interviews:**

- There could be delays as a result of respondent availability.
- Interviews could be constrained with respect to time.
- There are costs involved with regard to travel to and from site.
- The respondents may not be motivated to co-operate and thus provide accurate information.

### ❖ **Secondary Data Analysis**

This will entail looking at all the gazetted legislation and White Papers, pertaining to the study at hand. The archives of the DWAF and university libraries (DWAF, UND and UDW) will be investigated for any prior research or studies. This could be a source of information as well as be a means to avoid any duplication of research. These institutions will also be a source of bibliographic information. An online search will be conducted to seek any latest developments in waste disposal and access other pertinent information.

### ❖ **Experience Survey**

It is the researcher's belief that using this type of survey could prove beneficial to this study. This will lead to interviewing people with the expertise and knowledge on important aspects of the subject of waste management in South Africa, and management of waste disposal sites in particular. The investigative format should be as flexible as possible so that various avenues can be explored to enable as much probing as possible.

### ❖ **Ethical Considerations**

Ethical standards will be maintained throughout the study. The following guidelines are to be adhered to. The researcher will:

- Ensure that the study will be conducted as objectively as possible with no bias.
- Ensure that respondents are treated with respect and assured of complete privacy and confidentiality.
- Ensure that informed consent is sought from all parties in order not to jeopardise the integrity of the respondents.
- Ensure that all information gathered will be used for research purposes only.

### ❖ **Limitations of the Study**

- Only a single waste disposal facility in Kwazulu-Natal was selected.
- Only a single type of waste disposal facility was selected.
- The Department of Water Affairs and Forestry, the Local Authority and the landfill site Manager may be reluctant to participate for fear that this study may have negative implications on their management of the landfill site.

## 7. ORGANISATION OF THE STUDY

The study will consist of the following chapters: -

- **Chapter One:** This is the introductory chapter that presents the problem to be investigated, the aims of the study and the method of research that will serve as a basis for evaluation and discussion.
- **Chapter Two:** This chapter will look at the relevant literature and previous studies pertaining to waste management and to disposal at landfills
- **Chapter Three:** This chapter deals with the research methodology and specifically focuses on a case study method of research. The Umlazi Landfill Site was chosen as the case study.
- **Chapter Four:** This chapter deals with the discussion of findings and evaluation thereof. Here the 'gap analysis' is done and reasons are given thereto.
- **Chapter Five:** This chapter consolidates the study where conclusions are drawn and recommendations are made. This is done with cognisance of the limitations of the study as stated in the previous section.

## 8. CONCLUSION

This Chapter sets the scene for the study to follow. We see that local authorities did not manage waste disposal effectively, in the past. Waste was indiscriminately dumped at landfill sites. Predominantly, it was a sector in local government that was not regulated. With the resultant effects of poor waste disposal practices at landfills, public pressure and the degradation of the environment, that prompted National Government to promulgate a plethora of laws to regulate waste management in South Africa. The Minimum Requirements for solid waste disposal at a landfill was an attempt to upgrade the standards of landfilling in South Africa. However, compliance with the Minimum Requirements is rarely achieved. This study will attempt to look at the reasons hereto, discuss the findings, draw conclusions and make recommendations that will aid in the effective implementation of the Minimum Requirements at a local authority level.

## CHAPTER TWO

### LITERATURE REVIEW

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#### 1. INTRODUCTION

Environmental management initiatives on the international, political and administrative levels are often referred to as macro-environmental management, and environmental management approaches on the business level are referred to as micro-environmental management.

However, since both macro- and micro-environmental management is aimed at the same goal, namely sustainability, the environmental management initiatives on these different levels share certain basic principles. Principles for environmental management at a macro-level originated from international initiatives, such as the *Caring for the Earth* initiative (Fuggle and Rabie, 1994:2,3), the principles set out in the Rio Declaration (UNCED, 1992) and Agenda 21. In South Africa, macro-environmental management principles are incorporated into the National Environmental Management Act of 1998, Integrated Environmental Management (IEM) procedure, and the National Water Act (Act 36 of 1998). The waste management principles in particular are incorporated in the National Waste Management Strategy.

This chapter will look at environmental management practice in general, whilst concentrating on waste management in particular with emphasis on solid waste disposal at general landfill sites. A PEST analysis will be used to assess waste management practice and such practice in South Africa. Focus will then be made on the Political aspect of the PEST analysis, wherein the relevant legislation and the Minimum Requirements pertaining to solid waste disposal at landfill sites, will be highlighted and discussed.

In order that the Minimum Requirements at a landfill site are successfully implemented and legally enforceable, it has to be incorporated in a permit or form part of a local authority by-law. Compliance and monitoring of the adherence to legislation and permit



has to be done firstly and by competent and adequately trained people. According to Thomas and Strickland (2001), who says that for successful implementation to occur, an organisation must have the competencies, capabilities, and resource strengths to carry out any strategy. This includes putting together a strong management team, recruiting and retaining competent employees, employee training, developing and strengthening core competencies amongst others. The organisation must develop budgets to steer ample resources critical to strategic success. Policies and procedures need to be developed in order to support any strategy. In order to maintain strategic success, institute best practices and push for continuous improvement on how activities are performed.

## **2 BACKGROUND OF THE STUDY**

South Africa is emerging from a period of unsustainable and inequitable development, one outcome of which was environmental degradation, which has significant economic and social impacts. Part of effecting a transformation to development that is economically, socially and environmentally sustainable is to redefine the way in which pollution and waste will be managed in South Africa.

Much-needed economic growth can be supported by more appropriate and efficient use of natural resources, within a framework of integrated pollution and waste management. This will help to protect the people of South Africa and the environment without a continuous degradation of natural resources.

Although government has promulgated extensive legislation and regulations over the last few years to address threats to environmental and human health, a number of limitations have become clear:

- Limits of impact management
- Limited civil society involvement
- Inadequate integration of environmental media
- Inadequate integration across government departments
- Lack of capacity to implement
- Inadequate consideration of global environmental issues.

Some of the initiatives for the implementation of environmental management at micro-level can be found in the International Chamber of Commerce (ICC) Business Charter for Sustainable Development (ICC, 1991 and SABS, 1996), and the Responsible Care programme supported by the South African Charter of the Chemical and Allied Industries Association (CAIA) (CAIA, undated). One of the international standard systems that specifies the requirements of an environmental management system, ISO14001, is intended to provide businesses with the elements of an effective system that will assist in the achievement of environmental and economic goals (SABS, 1996). indicates the environmental management principles shared by the above-mentioned initiatives and systems at macro- and micro-level.

Environmental management should not be confused with the management (manipulation) of the natural environment (the management of plants and animals and nature conservation), but must be seen as the management of man's activities within the carrying capacity of environmental systems. Environmental management is aimed at achieving this goal of sustainability, a concept that can be described as a state of equilibrium between the demands placed by man on natural resources, and the ability of these resources to assimilate such demands without compromising the functioning of their systems.

When the development and use of natural resources have to be managed in such a manner that they are environmentally sustainable, several initiatives and specific management processes must be implemented. Such initiatives and management processes have been developed over the latter part of this century, and are known as "environmental management" processes. In this context, the term environment is used in its broadest form, and includes biophysical, social, economic, historical, cultural and political aspects. Gilpin (1996:170) states that: "Environmental management is a concept of care applied to individual premises, corporate enterprises, localities, regions, catchments, natural resources, areas of high conservation value, lifetime cycles, waste handling and disposal, cleaner processing and recycling systems, with the purpose of protecting the environment in the broadest sense. It involves the identification of objectives, the adoption of

appropriate mitigation measures, the protection of ecosystems, the enhancement of quality of life for those affected, and the minimisation of environmental costs”.

The overall goal of environmental management from a sustainable development perspective is to minimise safety, health and environmental impacts, while at the same time optimising economic, social and psychological impacts on society (Asante-Duah, 1993:9). Of particular note in this approach are:

- The holistic approach to the environment. Reduction of pollution in one medium, such as air, may not take place at the expense of another, such as ground or surface water.
- The emphasis on a long-term solution, implying that there should be no bad legacy for the next generation, which re-iterates the concept of sustainability.
- The consideration of all alternatives in order to implement the best alternative is known as the Best Practical Environmental Option (BPEO).

The environmental deterioration of the earth, especially during the last century of the second millennium, has two main causes. The exponential increase in the world’s population, the growing sophistication of its needs and activities for the maintenance of present-day lifestyles, and the process of industrialisation, have not only resulted in a vastly increased pressure on and depletion of the earth’s essential natural resources, they have also caused the increased generation of enormous quantities of waste (Fuggle and Rabie, 1994:1).

The production of waste, an unavoidable and unwanted by-product of all man’s activities, is characteristic of mankind, and inevitable in a modern society. The more advanced the level of civilisation, the greater the production of waste, in liquid as well as in solid form, which has to be managed, and ultimately accommodated in the environment. Furthermore, indications from available data show that the amount and hazardous nature of waste generated is in almost direct relation to the growth of the economy. The management of waste, and especially its disposal, is a growing problem (Parsons & Jolly, 1994:1), since it may contain substances that, if not effectively controlled, can be harmful

to humans and the environment. The CMC Integrated Solid Waste Management Feasibility Study summarises the situation in South Africa fairly well in the statement, “Worldwide, modern landfills that are properly designed and operated are the most cost-effective and environmentally acceptable means of waste disposal when population density and land availability are not at issue. Because of this, the use of landfills as the primary means of waste disposal in South Africa is a premise of this integrated waste management study, for those materials that cannot otherwise be recovered.”

### **The Integrated Pollution and Waste Management Policy**

The Integrated Pollution and Waste Management Policy outlines the Government’s new thinking in relation to pollution and waste management.

In line with international trends and national objectives of efficient and effective management of our nation’s resources, priority is given in this new approach to prevention. Unlike previous policies that focussed predominantly on so-called “end-of-pipe” treatment, this Policy underscores the importance of preventing pollution and waste and avoiding environmental degradation. Waste is most logically managed in the following order:

- Avoid
- Recycle/Reuse
- Treat
- Safely Dispose

This in a nutshell is termed Integrated Waste Management.

Effective mechanisms to deal with unavoidable waste will remain necessary, but much greater attention must be directed to the introduction of preventative strategies aimed at waste minimisation and pollution prevention. Ever increasing urban and industrial development throughout the world is leading to levels of pollution, which seriously threaten the natural resources upon which humankind depends for its survival. Although South Africa has extensive environmental, pollution and waste management

legislation, responsibility for its implementation is scattered over a number of departments and institutions.

The fragmented and uncoordinated way pollution and waste is currently being dealt with, as well as the insufficient resources to implement and monitor existing legislation, contributes largely to the unacceptably high levels of pollution and waste in South Africa. This Policy will ensure the implementation co-operative governance as envisaged in the Constitution. The current fragmentation, duplication and lack of co-ordination will be eliminated. The Integrated Pollution and Waste Management Policy will result in a review of all existing legislation and the preparation of a single piece of legislation dealing with all waste and pollution matters.

Pollution and waste management is not the exclusive preserve of government. The private sector and civil society have crucial roles to play. The fostering of partnerships between government and the private sector is a prerequisite for sustainable and effective pollution and waste management to take place. Similarly, the spirit of partnerships and co-operative governance between organs of state is equally important due to the crosscutting nature of pollution and waste management.

Monitoring and collection of information on pollution and waste generation are crucial for the implementation of pollution and waste reduction measures. Moreover, the sharing of such information and creating awareness about the issues will enable all stakeholders, including communities, to gain a better understanding of the relation between pollution, waste management and the quality of life.

The objective of integrated pollution and waste management is to move away from fragmented and uncoordinated waste management to integrated waste management. Such a holistic and integrated management approach extends over the entire waste cycle from cradle to grave, and covers the prevention, generation, collection, transportation, treatment and final disposal of waste. Integrated waste management thus represents a paradigm shift in South Africa's approach to waste management, by moving away from waste management

through impact management and remediation and establishing instead a waste management system which focuses on waste prevention and waste minimisation.

The Integrated Pollution and Waste Management Policy outlines the waste disposal criteria as follows:

- To compile a register of all waste disposal facilities in the country.
- To ensure that the plans for implementing the Minimum Requirements at all Section 20 waste disposal facilities are drawn up by the facility owners and submitted to the Department of Water Affairs and Forestry for their approval and records
- The Department of Water Affairs and Forestry will ensure that all medium and large landfill sites are permitted, following submission of required permit application reports by landfill owners
- The Department of Water Affairs and Forestry will carry out appropriate monitoring and auditing of all registered Section 20 waste disposal facilities, to enforce the applicable Minimum Requirements, regulations and permit conditions
- Compliance with the relevant laws, regulations, standards and guidelines
- To formalise and control existing salvaging on landfills, as an interim measure, through agreements between landfill owners and salvagers. Permits will be amended, where necessary, to take into account agreements on salvaging. Salvaging will not be allowed to commence on landfills where it is not currently taking place
- To initiate the establishment of adequate hazardous waste disposal facilities for all parts of the country, to be carried out by the provincial environmental departments, in collaboration with municipalities
- The Department of Water Affairs and Forestry, together with the Department of Environmental Affairs and Tourism, will issue updated, extended and amended Minimum Requirements documents, taking into account comments based on operational experience.

## **The National Waste Management Strategy (NWMS)**

South Africa is emerging from a period of unsustainable and inequitable development (one outcome of which was environmental degradation), which has significant economic and social impacts. The NWMS presented a long-term plan for addressing key issues, needs and problems experienced with waste management in South Africa. The strategy gives effect to the Bill of Rights, Constitution of South Africa, Act 108 of 1996, on the basis of which the people of South Africa have a right to an environment that is not detrimental to their health. Furthermore, the strategy translates into action the Government's policy on waste management, as set out in the Integrated Pollution and Waste Management Policy. The National Waste Management Strategy presents Government's strategy for integrated waste management for South Africa. The Strategy presented in this document was compiled by the Department of Environmental Affairs and Tourism and the Department of Water Affairs and Forestry, in consultation with a wide range of stakeholders, including: government at all levels, non-governmental organisations, community based organisations, labour, business, industry, and the mining sector.

This National Waste Management Strategy presents a long-term plan (up to the year 2010) for addressing key issues, needs and problems experienced with waste management in South Africa.

The strategy aims to reduce both the generation and the environmental impact of waste. It presents a plan for ensuring that the socio-economic development of South Africa; the health of its people and the quality of its environmental resources are no longer adversely affected by uncontrolled and uncoordinated waste management. It establishes a waste management system that concentrates on avoiding, preventing and minimising waste and makes provision for waste management services for all by extending an acceptable standard of waste collection, as well as transportation, treatment and disposal services to all communities.

While the long-term objective of the strategy is waste prevention and minimisation, a number of remedial actions such as improved waste collection and waste treatment are required in the shorter term due to prevailing inadequate waste management practices.

According to the integrated waste management hierarchy, waste disposal is the last waste management option that should be considered. (See Figure 1). Although waste minimisation and recycling reduce the amount of waste that requires disposal, a portion of the waste stream will still require final disposal at a landfill site.

The key criteria identified in the NWMS for safe waste disposal are:

- To minimise the environmental impact of all disposal sites by ensuring that these sites are permitted and controlled through regulations. Sufficient waste sites will be planned to meet all of South Africa's disposal requirements and ensure that health and environment are not compromised. The Department of Environmental Affairs and Tourism will identify suitable sites for treatment and disposal, in collaboration with all relevant stakeholders.
- To ensure that each waste type receives the correct method of disposal and that the disposal is at a properly engineered landfill site.
- To phase out the co-disposal of specified hazardous wastes with general and other non-hazardous wastes.
- To ensure that the auditing of waste disposal operations is undertaken.
- To review and update guideline documents for waste disposal operations on a regular basis.
- To review and revise the closure plans for waste disposal sites on a regular basis.
- Abandoned waste disposal sites, including mine waste sites, will be placed on an inventory for assessment and a remediation programme for the abandoned sites will be developed and implemented.
- Promulgation of landfill site classification system and regulations.
- Registration of all landfill sites and preparation of remediation plans.



- Establish permit/audit plans for mining and power station sites.
- Develop guidelines for inorganic hazardous waste disposal.
- Develop an inventory and assessment programme for the remediation of abandoned mines and power station sites.
- Permitting and management of all landfills in accordance with the DWAF Minimum Requirements.
- Review the DWAF Minimum Requirements every 5 years.
- Initiate feasibility study into mining and power station waste disposal.
- Establish a process to review closure plans for mining and power station waste sites.
- Formalise and control salvaging on general landfill sites.

The NWMS follows the waste hierarchy approach as shown below.

<b>Waste Hierarchy</b>	
<b>Cleaner Production</b>	<b>Prevention</b>
	<b>Minimisation</b>
<b>Recycling</b>	<b>Re-Use</b>
	<b>Recovery</b>
	<b>Composting</b>
<b>Treatment</b>	<b>Physical</b>
	<b>Chemical</b>
	<b>Destruction</b>
<b>Disposal</b>	<b>Landfill</b>

**Figure 1: Steps in Waste Hierarchy**

According to 152R-DACEL IWMP Draft 2 Guideline Document of May 2002, in developed industrialised countries, waste management problems have historically been manifested and addressed. Another general characteristic of many of these countries is a long established environmental awareness. This together with adequate resources has made it possible not only to implement basic waste management systems to address the problems, but also to develop appropriate philosophies and ethics as waste management has evolved. These logically address the reduction of waste generation by prevention and minimisation, through efficient production methods and use of resources. Also the waste stream is reduced by resource recovery. Finally hazardous wastes are treated prior to final disposal to reduce the associated risks. These elements are included in the internationally recognised Waste Management Hierarchy or the Integrated Waste Management Approach, as depicted in Figure1, above.

The Minimum Requirements for Waste Disposal by Landfill forms part of the Department of Water Affairs and Forestry's Waste Management Series. This series establishes a reference framework of standards for waste management in South Africa. It also facilitates the enforcement of the landfill permitting system provided for in terms of Section 20(1) of the Environment Conservation Act, 1989 (Act 73 of 1989). The Act states that no person shall establish, provide or operate any disposal site without a Permit issued by the Minister of Water Affairs & Forestry and subject to the conditions contained in such a Permit. This applies to all new and operating sites.

In this document, the procedures, actions and information that is required from an applicant when permitting a landfill, or written into a permit as conditions, are set out in the form of Minimum Requirements. The objective of setting Minimum Requirements is to take pro-active steps to prevent the degradation of water quality and environment, and to improve the standard of waste disposal in South Africa. To ensure practical and affordable environmental protection, graded requirements are applied to different classes of landfill. The landfill class is determined from the waste type, size of operation, and potential for significant leachate generation. Where significant leachate is generated,

leachate management is mandatory. Where hazardous waste is involved, the most stringent Minimum Requirements are applicable. There is an important relationship between all aspects of the landfill development process. Good landfill site selection provides for simple cost-effective design, which, provided the site preparation is correctly carried out, provides for good landfill operation. This in turn ensures the environmental acceptability of the landfill. Environmental acceptability, in its turn, often relates directly to public acceptability. Minimum Requirements are therefore set for all technical aspects of landfill development, operation and closure. They are also set for involving Interested and Affected Parties (IAPs) in determining site feasibility and end-use requirements.

The Permit Holder is primarily and ultimately accountable for the landfill and any effect it may have on the receiving environment. However, the Permit Holder may appoint a Responsible Person, for example, a consultant or operator, to ensure that the appropriate Minimum Requirements are applied throughout the development, operation and closure of the landfill. The Responsible Person must be qualified to the satisfaction of the Department and must be capable of understanding and correctly applying the Minimum Requirements.

The term 'landfilling' refers to the deposition of waste on land, whether it be the filling in of excavations or the creation of a landfill above grade, where the term 'fill' is used in the engineering sense. Historically, wastes have been disposed of on land. This is because landfilling is the cheapest and most convenient method of waste disposal. It is estimated that an excess of 95% of the waste generated in South Africa is disposed of in landfills, while the world figure is believed to be in excess of 85%. No matter what waste minimisation technologies are implemented, whether they be for volume reduction or resource recovery, some form of residue will always remain and waste will continue to be generated. This is ultimately disposed of in a landfill, the most commonly used method for ultimate disposal.

The disposal of both general and hazardous waste by landfill is the most cost-effective option. Illegal dumping and the creation of informal landfills (often in the form of burning on open dumps) is a major problem in lower income communities, due to the

lack of organised collection of general and hazardous waste and exacerbated by a lack of environmental ethics. Medical waste is often disposed at these sites, and informal salvagers and the general public, especially young children, are at risk of contracting Tetanus, Hepatitis and other diseases from this practice. A related, and very serious problem is the illegal disposal of hazardous chemical wastes on general waste landfills and open dumps.

In the past, the emphasis of waste management in South Africa has been on waste disposal. Waste disposal, however, has an adverse impact on the environment and public health, particularly in cases where there has been no thorough waste management planning, the landfill has been inappropriately sited and designed and inadequately managed and operated.

Increased environmental awareness during the 1980's focused attention on landfill sites and a landfill permitting system was consequently developed by DWAF. To establish standards for implementing the landfill permitting system, DWAF also produced the Minimum Requirements documents, including the Minimum Requirements for Waste Disposal by Landfill, the 1<sup>st</sup> Edition in September 1994 and the 2<sup>nd</sup> edition in September 1998. The main effect of the Minimum Requirements was the improvement of the quality of landfilling throughout the country, due to upgrading and higher environmental standards for landfill sites; on the other hand there was a concomitant increase in the cost of disposal. At present very few landfill sites charge disposal tariffs although this situation will be addressed as a mechanism of cost recovery.

There are a limited number of disposal sites in South Africa, which dispose of hazardous waste in an acceptable and professional manner and in accordance with the Minimum Requirements. Since there are not enough of these facilities, hazardous waste is often transported over long distances, resulting in increased risks of accidents and higher transport costs.

Based on an 85% return, the IPC&WM baseline survey of June 1997 identified 540 operating landfills and 53 future sites in South Africa. It was noted that there could be up

to 15 000 unrecorded communal sites in the rural areas. Of the 540 sites recorded, only 115, or 26% were permitted at that time. According to DWAF, there are currently 368 landfills permitted, which represent approximately 60% of the total.

The inappropriate treatment and disposal of mining and coal combustion wastes has often resulted in contamination of water resources by salts, iron and many other trace elements. Acid mine drainage resulting from the oxidation of iron pyrites, as well as the presence of elevated levels of naturally occurring radioactive materials at some mine disposal sites, are of considerable concern. The pollution potential of these wastes is not completely understood and it is essential that appropriate standards are set and guidelines published to control the treatment and disposal of these wastes.

Landfilling is environmentally acceptable if properly carried out. Unfortunately, if not carried out to sufficiently high standards, landfilling has the potential to have an adverse impact on the environment. This impact may be divided into short-term impacts and long term impacts:

- **Short term impacts**

Short-term impacts include problems such as noise, flies, odour, air pollution, unsightliness and windblown litter. Such nuisances are generally associated with a waste disposal operation and should cease with the closure of the landfill.

- **Long term impacts**

Long -term impacts include problems such as pollution of the water regime and landfill gas generation. Such problems are generally associated with incorrect landfill site selection, design, preparation or operation and may persist long after the landfill site has been closed.

The general objective of environmentally acceptable landfilling, therefore, is to avoid both short or long term impacts or any degradation of the environment in which the landfill is located. More specific objectives are pro-actively to prevent pollution of the surface and ground water and ensure public acceptance by ensuring environmental acceptability.

A PEST analysis was done to look at waste management practice from a holistic or macro perspective, in terms of the Political developments, the Economical consequences, Social implications and Technological requirements.

### **2.1. Economical**

According to Dohrman and Marler (1999) who say that as with any Municipal Service, a landfill needs to be sustainable. It is therefore necessary that the users can afford the total “package”, i.e. capital costs and operational requirements. With the ever-increasing number of low-income households that were not previously part of the waste disposal service provided by Local Authorities, the financing of recurrent costs is even more important than simply looking for capital for the development of a landfill site. Of particular importance is the need to mitigate against the risk of future expenses caused by environmental degradation and consequential negative social impacts through inappropriate design and/or operation. Solid waste removal services have not always been provided to all areas of local authorities in South Africa. In developing urban areas, even today, the service is often not being provided at a satisfactory level. It is also reported that in these areas many members of the community are not paying for services in general, such as water, sanitation and sometimes, not even for electricity consumption. It is therefore difficult for the local authority to collect service fees for solid waste management in order to ensure that such a service is sustainable. Local authorities are under tremendous pressure to provide basic services to low-income communities where cost recovery in any form is problematic. Recently, capital works programmes have been restricted to addressing backlogs in these basic services and consequently operations and maintenance budgets have been severely cut back to the point where deterioration of existing infrastructure is of major concern to these authorities.

### **2.2 Social**

According to the Water Research Commission Report No. 629/1/96, the generation of substantial quantities of waste is an inevitable consequence of modern-day urban living. The waste impacts on the human and natural environment, and the nature and extent of

impact is dependent on a number of factors, including the quantity and composition of waste; the adequacy of collection services and the methods of disposal. The extent of recycling and re-use is also significant, as this affects both the quantity and the composition of the matter that needs to be absorbed into the environment.

On the national level, issues such as toxic build-up in soil and water from inadequately managed landfill sites are important, and they will eventually affect the population and the economy as a whole. But in inadequately serviced and generally overcrowded low-income urban areas and rural areas, there are major problems that result from inadequately managed landfill sites. These are the following:

### **1. Health Problems**

For people living in areas where waste disposal is either inadequate or totally absent, this makes life not only unpleasant but also more hazardous. This poses a health risk both directly and via its effects on water supplies and drainage systems. This risk is related to the following factors:

- **Surface Water Resources**

Possibly the most serious risk to health posed by inadequate waste disposal relates to the effects on any local water resources in the vicinity of the landfill site and storm-water runoff from the landfill site. Leachate generation at a landfill site is a common occurrence; however managing this adequately can be a problem. If not detected early and effectively managed, the drainage of leachate into nearby rivers and streams can cause significant water pollution. Contaminated water exposes people to the risk of many 'faecal-oral' diseases, including cholera, typhoid fever and the more common ones such as intestinal parasites and diarrhoeal diseases. Although less severe the latter can be debilitating, and even fatal among undernourished children and the elderly in particular. (World Health Organisation: 1991). A study conducted in Khayelitsha revealed that the entire storm-water system was highly microbiologically polluted, for the purposes of both ingestion and direct contact (Wright et al: 1992).

- **Groundwater Resources**

Leakage of leachate into the groundwater system can cause significant water pollution as well. This is even harder to detect and can only manifest as a problem long after commencement. This can be a threat to health yet again, if the water is accessed for domestic or agricultural use. Wright et al are investigating the extent of this problem in the South African context.

## **2. Pests**

Concentrations of organic waste that are not properly compacted at a landfill site attract pests such as flies, rats and cockroaches. These pests besides being a nuisance can be carriers of diseases such as hepatitis A, trachoma and diarrhoeal diseases. (Hardoy et al: 1992)

## **3. Air Pollution**

Decay can give rise to gases that are harmful and malodorous. The methane and carbon dioxide produced have been linked to the 'greenhouse effect' and the depletion of the ozone layer. Methane has an additional effect of being explosive. (Jarman et al: 1994). Ash and noxious fumes from burning can also be a problem.

## **4. Injury**

Some landfill sites allow people to scavenge, whilst some people do it illegally on sites that are not properly secured. This can pose a risk of injury from broken glass and rusty tins. They are further exposed to risk if they eat discarded scraps of food that might be contaminated.

## **5. Aesthetic Effects**

Ineffective solid waste disposal at a landfill site shows waste to be aesthetically objectionable, both visually and due to the smell from rotting waste. This affects nearby resident populations and the wider community.

### **2.3 Technological**

According to Ball and Legg (1997), the objective of appropriate technology for landfilling in developing countries is to match the desired protection of public health and environment, afforded by modern landfill theory, with the realities of ambient environmental standards and affordability, existing in developing countries.



Economically developing countries are those, which, according to Campbell (1993), have a GDP that is lower than the world average. Such countries are characterised by poverty and limited technical and economic resource bases. Nonetheless their waste requires to be properly managed if environmental degradation and health risks are to be avoided. Rushbrook and Finneycy (1988) state that, although there is no single correct method to achieve proper waste management in developing countries, the common needs must be addressed. Almost without exception, regardless of local climate and waste composition, the need in developing countries arises from the predominant form of waste disposal, the burning open dump. These unacceptable waste disposal facilities, often sited immediately adjacent to residential areas, generally contravene all the accepted landfill principles, with regard to siting, design and operation.

Few waste managers will dispute that landfilling is the appropriate waste disposal technology for developing countries. However, the landfill technology itself must be appropriate, if it is to provide sustainable environmental and public health protection in the long term. Examples throughout history have demonstrated that if inappropriate technology is imposed on a given situation, problems will result with time. Landfill technology is no exception.

In developing countries, on account of their frequently limited technical and economic resource bases, long term affordability and sustainability of standards become very important issues. It is in this context we need to take cognisance of consistency in standards, the defensible adaptation of standards, appropriate levels of technology, the use of local resources and the need for ongoing involvement and capacity building.

Although any new landfill should represent a significant improvement on the status quo, this is meaningless unless there is some degree of consistency in standards in the same area. This should be achieved by a holistic approach that addresses the upgrading and rehabilitation of all operating, closed or abandoned landfill sites in the area. It is therefore seldom possible to move from burning open dump situation to a state-of-the-art landfill in one step. An approach involving progressive improvement is therefore advocated. This view is supported by Campbell (1993) and the UMP Working Paper of 1996.

A landfill that is inadequately managed or without proper leachate and/or gas extraction technology gives rise to the following adverse environmental impacts:

### **1. Greenhouse Effects and Ozone Depletion**

Landfills contribute significantly to the global anthropogenic methane emission. Methane is a more powerful greenhouse gas than carbon dioxide, due to its radioactive forcing ability. Fluorinated hydrocarbons, which are disposed of at a landfill are quite volatile, and are expected to escape from a landfill within the first years of disposal.

### **2. Odour**

The main landfill gas compounds giving rise to odour problems are hydrogen sulphide and organic sulphide compounds (mercaptanes). The main problems exist during operation of the landfill.

### **3. Noise**

Noise is a major local annoyance cause by the traffic of the waste collection trucks, by the emptying of trucks and by the compactors and earthmoving equipment. In some instances, a large gathering of birds attracted by the waste may in itself create a noise problem. Noise problems may be remedied by technical improvements of the equipment, soil embankments and tight vegetation around the filling area and by reduction in working hours.

### **4. Explosion and Fire Hazards**

Landfill gas is explosive mainly due to the methane content. If landfill gas is vented directly to the atmosphere, no explosion hazard exists, but surface fires have been observed. One of the main environmental hazard related to landfill gas is believed to be the explosion hazard by landfill gas entering houses through cracks in foundations, penetrating services etc. After mixing of the gas with air, an energizer (spark in electrical components, lighting of match, etc) can initiate an explosion.

### **5. Vegetation Damage**

Many cases of damages to vegetation in the vicinity of landfills are reported in literature. The main reason for damages to vegetation from landfill gas is asphyxia by removal of

oxygen in the root zone. This removal can either be due to a displacement of oxygen by landfill gas or by oxidation of methane.

## **6. Soil Pollution**

Pollution of the soil on the land surrounding the landfill could be caused by spills from collection vehicles, dust migration of the premises or waste and polluted soil carried away by erosion due to storm-water. A tidy operation and appropriate surface run-off channels can significantly reduce the problems of soil pollution.

‘Alternative waste management technology’ refers to the use of the first three options in Integrated Waste Management, i.e., avoidance, recycling or reuse, and treatment rather than disposal.

**Waste avoidance** is waste minimisation that takes place without recycling or reuse. It can be as simple as careful shopping to buy biodegradable packaging or it can be more complex, such as the redesign of a process so that a waste will not be created. Examples of waste avoidance would be avoidance of high water consumption, energy consumption and chemicals.

According to the UNEP definition of cleaner production, “Cleaner production focuses on source reduction, waste minimisation, energy efficiency and low-waste and non-waste technology, with the objective to prevent or minimise, in the most cost-effective manner, the short and long term risks to human and the environment.” In South Africa, it is believed that the term describes a comprehensive preventative approach to environmental protection. Changing attitudes; applying know-how and improving technology can achieve cleaner production.

**Recycling and reuse** is when a waste is taken out of the waste stream and either transformed into another product (recycled) or used again (reused). However, not everyone can reuse materials. Recycling is therefore now a manufacturing industry that depends on raw materials donated by millions of individuals. Wastes that are commonly recycled include paper, tins, metals, glass, oils, food wastes and white goods. The use of methane gas from landfills for energy can also be seen as a form of recycling.

**Treatment** can be volume reduction or changing the physical or chemical properties of a waste to make it reusable or less toxic. Examples of treatment would be the mixture of acidic and alkaline wastes to neutralise them or the solidification of liquid wastes.

## 2.4 Political

Legislation is a key tool for the effective implementation of a comprehensive waste management system. It is important that at least the basic requirements of the waste management system are embodied in legislation so that a framework is established in which the rules of the system are clear, certain, accessible, applied consistently and legally enforceable. In order to understand how waste management is governed in South Africa a distinction must be made between original or primary legislation, and subordinate legislation. We must also know the hierarchy of original or primary legislation.

- Original or primary legislation pertains to Acts of Parliament, as well as Laws made by the nine provinces.
- Subordinate legislation derives its authority from primary legislation, and includes regulations, ordinances, proclamations, authorisations such as licences, general authorisations, or permits, and even policy. In other words, it is a legal instrument made in terms of a specific Act.

The hierarchy of authority of legislation in South Africa is as follows:

5. The Constitution
6. Parliamentary or National Legislation (Acts of Parliament)
7. Provincial Legislation
  - Laws from 1994
  - Proclamations between 1986 and 1994
  - Ordinances before 1986
8. Local authority Bylaws

### **2.4.1 Relevant Legislation**

- **Constitution (Act No. 108 of 1996)**

The Constitution of the Republic of South Africa (Act 108 of 1996) states that the people of South Africa have the right to an environment that is not detrimental to human health, and imposes a duty on the State to promulgate legislation and to implement policies to ensure that this right is upheld. Steps taken to date to ensure the environmental right include: the publication of the Environmental Management Policy for South Africa (1998); the White Paper on Integrated Pollution and Waste Management (1998); the National Water Act (1998); as well as the promulgation of the National Environmental Management Act (1998). A further step is the development of the National Waste Management Strategy for South Africa.

The Constitution provides the overall parameters for developing an Integrated waste Management Plan by, inter alia, specifying the powers and responsibilities of each sphere of government. (It allocates responsibility for refuse removal, refuse dumps and solid waste disposal to local government). It also contains a Bill of Rights, which must be upheld and given effect to by government, including an environmental right. In certain instances, original law making powers are granted to local government.

- **National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)**

This Act establishes the parameters for environmental governance generally. Of particular significance is the fact that section 2 contains a set of principles, which apply to the actions of all levels of government. The Act also requires the submission of environmental implementation plans by the provinces, which must be adhered to by local government. This Act also provides for co-operative environmental governance by establishing principles for decision making on matters affecting the environment. As the principal framework act for environmental issues, it has direct relevance to the implementation of the National Waste Management Strategy.

- **Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA)**

The Environment Conservation Act is the only Act, which specifically regulates waste management. It contains provisions in respect of littering (section 19 & 19A); requirements in respect of the disposal of waste and operation of a waste disposal facility (section 20) and empowers the Minister to make regulations in respect of waste management (section 24). Although the department responsible for waste management in general is the Department of Environmental Affairs and Tourism, the Department of Water Affairs and Forestry is responsible for the permitting of waste sites. (The Minimum Requirements Series produced by the latter is an important source of information, although it does not have the status of law unless included in a permit).

Sections of the act, which are of specific importance to waste management, include:

Section 19: Littering and administered by Local Authorities

Section 20: Waste management (permitting of waste disposal sites)

Section 24 –Regulations regarding waste management. Although this section has an emphasis on waste disposal, it has significant potential to be used in implementing a number of the NMWS initiatives.

- **National Water Act, 1998 (Act No. 36 of 1998)**

The purpose of the Act is to ensure that the country's water resources are protected, used, developed and conserved in ways which take into account the protection of aquatic and associated ecosystems; that addresses basic human needs; that ensures the reduction and prevention of pollution; and that meets international obligations. Section 19 of the National Water Act deals with pollution prevention of water resources. This mandate is especially important when it comes to inadequate leachate management systems at a disposal site that could pollute the ground and/ or surface water resources

- **Health Act, 1977 (Act No. 63 of 1977)**

Amongst other provisions, section 20 of the Act places an obligation on local authorities to abate any nuisance in its area of jurisdiction. Sections 34 and 38 empower the Minister to make regulations, which could directly impact on waste management. This Act is used by the DWAF to determine the buffer zone of a proposed waste disposal site.

- **Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000)**

The Municipal Systems Act, inter alia, describes how the powers and functions allocated to local government must be managed. It does this by establishing principles, mechanisms and processes for local government, including the way in which powers and functions should be exercised, public participation, planning, human resource development and monitoring and standard setting.

- **The Local Government Transition Act 209 of 1993**

This Act makes provision for the powers and duties of local authorities (schedule 2 & 2(a)). In terms of the Act local councils must formulate and implement an integrated development plan incorporating land use and infrastructure planning. This development planning could include the determination of a waste disposal strategy and the identification of sites for waste disposal facilities.

In addition to the legislation set out above, it should be noted that there may be more than one local authority by-law in a particular area which regulates waste and its management that should be considered. These by-laws may have been passed in terms of the Local Government Ordinance, 1939 or other legislation, such as the Health Act.

Existing legislation on waste management in South Africa is generally fragmented, diverse and currently ineffectively administered. Responsibility for executing waste management functions and for the enforcement of the current waste related legislation is not always clear and is spread over a number of national, provincial and local government departments.

#### **2.4.2 The Minimum Requirements**

The Minimum Requirements are implemented through and enforced by the Landfill Site Permit, in terms of Section 20, of the Environment Conservation Act, 1989 (Act No. 73 of 1989). This is because the granting and retention of a Permit will depend on the landfill meeting the appropriate Minimum Requirements. The Minimum Requirements

programme is therefore implemented within an existing legislative framework. Once a Minimum Requirement is included in a Landfill Site Permit, it is legally enforceable.

In the case of a proposed site or an 'unpermitted' operating site, the Minimum Requirements are enforced during the Permit Application procedure. Those pertaining to public participation and environmental impact assessment are enforced in terms of the Environmental Impact Assessment Regulations of September 1997. All applicable Minimum Requirements must be met before a Permit can be obtained. The Department has the right to refuse to grant a Permit and, in the case of an operating landfill, to require that the landfill be closed.

In the case of a permitted site, the conditions appearing in the Permit represent enforceable standards for that specific landfill. Since Permit conditions will usually conform to or exceed the Minimum Requirements, the Minimum Requirements will also, in effect, become enforceable standards. The Department has the right to amend an existing Permit. In instances where existing landfills are unable to comply with the appropriate Minimum Requirements within an agreed period, they may have to be closed in accordance with the Minimum Requirements for closure. All landfill sites closed after August 1990, when the permitting system came into force, have to be permitted and will thus be subject to the Minimum Requirements. Any site closed prior to August 1990 may be required to be rehabilitated in terms of the Minimum Requirements, depending on its potential environmental impact. In the future, the enforcement of the Minimum Requirements will also be complemented and enhanced by regulations for the registration of generators and transporters of waste, and by a manifest system for the 'cradle to grave' control of hazardous waste.

Minimum Requirements are applicable throughout the lifecycle of the landfill process. Essentially the lifecycle consists of five main stages. These are:

**(a) Selection of a Landfill Site**

The Minimum Requirements related to this stage are:

- Classification of proposed site.



- Notification to all stakeholders of the necessity and intention to develop a landfill.
- Appropriate liaison with all stakeholders.
- Elimination of areas with fatal flaws.
- Identification of candidate landfill sites.
- Distance of buffer zone.
- Minimum saturated zone.
- Ranking of sites.
- Presentation of ranked sites to stakeholders.
- Site feasibility study.
- Site description.
- Completion of permit application.
- Preliminary geo-hydrological investigation.
- Preliminary environmental impact assessment.
- Identification of critical factors.
- Assessment of critical factors.
- Confirmation of no fatal flaws.
- Confirmation of most suitable site to all stakeholders.
- Compilation of feasibility report and present to DEAT (Provincial) and stakeholders.
- Confirmation of feasibility from DEAT.

**(b) Design of a landfill Site**

The Minimum Requirements related to this stage are:

- Appointment of a Responsible Person.
- Site Classification.
- Assessment of cover volume.
- Indication of unsaturated zone after excavation.
- Determination of available airspace.
- Estimation of airspace utilisation.

- Estimation of site life.
- Address any impacts identified by investigation and/or by the stakeholders.
- Site layout design.
- Surface drainage design
- Development plan.
- Closure or rehabilitation plan.
- Design of leachate management system.
- Design of the toe drains.
- Monitoring system design.
- End-use plan.
- Testing of soils and materials.
- Surface hydrology and drainage design. (Start of technical design)
- Requirements for lining.
- Water quality monitoring system.
- Leachate detection system.
- Leachate treatment system.
- Leachate management and monitoring system.
- Gas management and monitoring system.
- Cover requirements.
- Stability of slopes.
- Erosion control design.
- Design drawings and specifications.
- Approval of technical design.

**(c) Operation of a Landfill Site**

The Minimum Requirements related to this stage are:

- Signposting.
- All weather roads.
- Waste acceptance procedure.
- Fencing.
- Control of vehicle access.

- Site security.
- Operating Plan.
- Response action plan.
- Waste load allocations.
- Liquid Co-disposal ratios.
- Encapsulation specifications.
- Weighbridge.
- Collection of Waste disposal tariffs.
- Site office.
- Laboratory.
- Responsible Person.
- Sufficient qualified staff.
- Compaction of waste.
- Daily cover.
- Two week's cell or trench capacity.
- Protection of unsafe excavations.
- One week's wet weather cell capacity.
- Immediate covering of putrescibles.
- End-tipping prohibited.
- Three days' stockpile of cover.
- Final cover.
- Waste reclamation prohibited.
- Any reclamation operation formalised in Operating Plan.
- Registration of reclaimers.
- Protection of reclaimers.
- Protective clothing.
- Control of nuisances.
- Waste burning prohibited.
- Contaminated run-off containment.
- Leachate containment.

- Storm water diversion measures.
- 0,5m freeboard for diversion and impoundments.
- Grading cover or avoiding ponding.
- General site maintenance.
- Sporadic leachate reporting.
- Landfill gas control.
- Rehabilitation and vegetation.

**(d) Closure of a Landfill Site**

The Minimum Requirements related to this stage are:

- Responsible Person.
- Landfill Monitoring Committee.
- Conduct Audits.
- Conduct external Audit twice per annum.
- Appropriate records and data collection.
- Record deposition rate.
- Waste stream records.
- Landfill volume surveys.
- Collect climatic statistics.
- Water quality monitoring.
- Gas monitoring and control.
- Air quality monitoring.
- Monitoring of progressively rehabilitated areas.
- Ongoing maintenance.

**(e) Rehabilitation, Closure and End-use of a Landfill Site**

The Minimum Requirements related to this stage are:

- Determine/reassess End-use Requirements.
- Investigate landfill to determine closure requirements and to identify impacts.
- Obtain input on End-use Design by stakeholders.

- Confirmation of End-use Design by the Department of Water Affairs and Forestry.
- Design for upgrade/rehabilitation, if necessary.
- Design final shaping and landscaping.
- Design final cover or capping.
- Design permanent storm water diversion.
- Design anti-erosion measures.
- Closure Report.
- Compare actual condition of landfill to required condition.
- Written acceptance of Closure Report.
- Ongoing leachate management.
- Ongoing gas management.
- Ongoing inspection and maintenance.
- Implementation of Closure Report/Rehabilitation.
- Letter approving closure.
- Frequency intervals of inspection and monitoring (in months).
- Cover integrity.
- Integrity of drainage.
- Control of ponding.
- Control of fire.
- Monitoring vegetation.
- Monitoring security and prevention of illegal dumping.

### **2.4.3 Institutional Framework**

Institutional arrangements in both developed and developing countries are similar in that the responsibility for waste services tends to rest at the local authority level. However, policy development and legislative decisions tend to be taken at regional and national levels.

In the Netherlands for an example, it consists of 12 provinces, each with their own administration, provides a clear example of this approach. Waste policies are set at a national level but it is the responsibility of the local municipalities within the provinces to implement and pay for the implementation of these policies, and to collect and dispose of waste.

According to Bartone et al (1990a), in large systems the optimum scheme is to have all waste management delegated to one agency within the local government hierarchy. The agency should be positioned at a level that relates to the financial importance and the operational difficulties of the service, and have a top-level administrator, mid-level technical staffing and its own budget. The designation of such an agency however, does not preclude some operational functions being delegated to other public agencies at local level or to the private sector. Nevertheless Bartone et al (1990a) believes that one agency should be assigned the principal responsibility for strategic planning, coordinating solid waste management operations, contracting services and overseeing contract performance.

According to Barnard (1999), a number of government departments are managing the environment. Waste management affects the Department of Water Affairs and Forestry, the Department of Health, the Department of Minerals and Energy, and the lead department, the Department of Environmental Affairs and Tourism. The multidisciplinary impact of waste is such that the legislator decided to authorise two departments to manage waste. As previously mentioned, the Department of Environmental Affairs and Tourism manages all aspects of waste other than its disposal. The Department of Water Affairs and Forestry manages the disposal of waste.

According to the Constitution, responsibility for waste management functions is to be devolved to the lowest possible level of government, being local and provincial government. NEMA represents enabling legislation, which aims to integrate environmental management through co-operative governance. All tiers of government have the responsibility to ensure co-operative governance. A national or provincial government cannot prosecute a local authority, unless it is a last recourse of action.

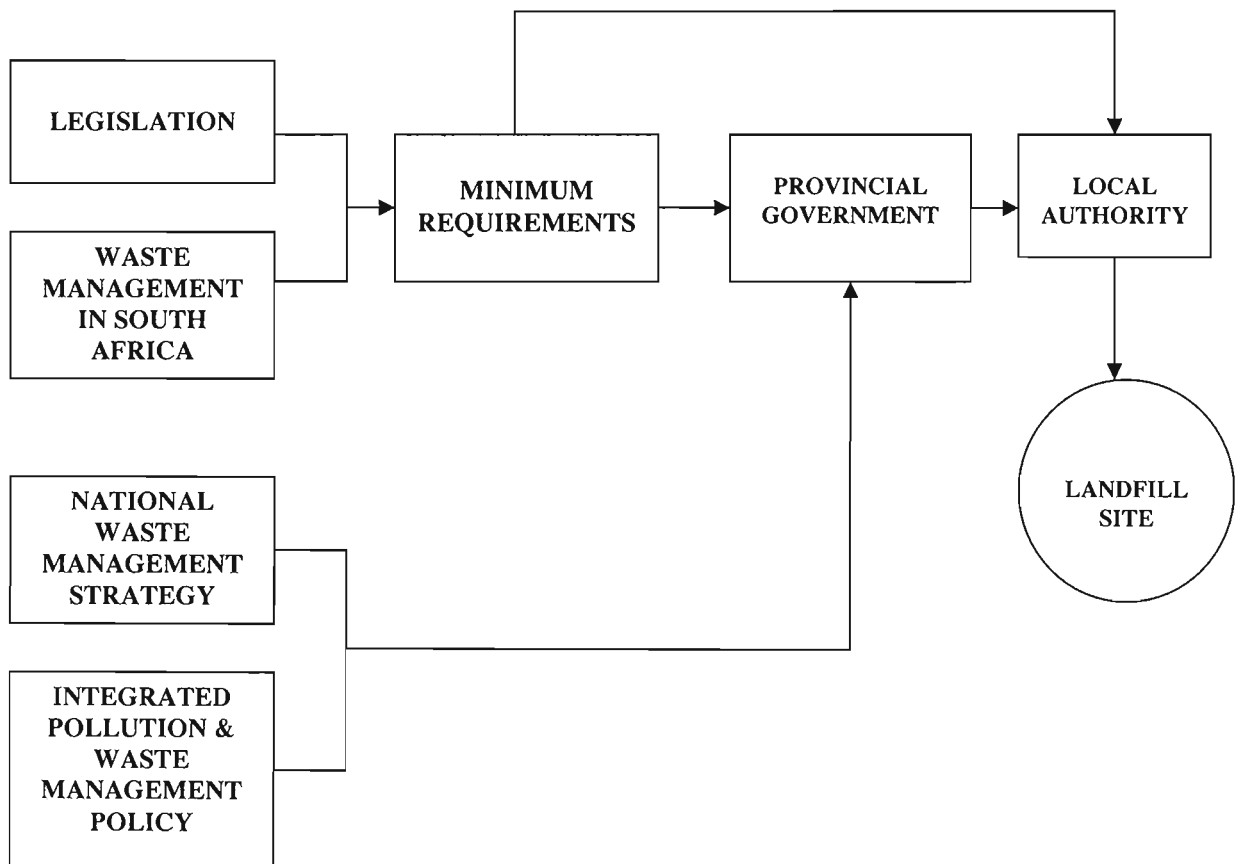
In terms of the National waste Management Strategy, all provincial departments of environment will be responsible for monitoring and enforcing functions relating to waste management in the province. One of the primary functions of provincial departments is the development planning to ensure that waste management considerations are integrated into development planning and decision-making. The local authorities are responsible for the provision of waste management services, including waste collection, transportation, treatment and safe disposal, as well as the management of the disposal facilities.

The role of Civil Society, which comprises the private sector, (individual industries and business sectoral organisations) and other organisations (such as Non Governmental Organisations, Community Based Organisations, universities and research institutions), is pivotal for ensuring that waste minimisation procedures are effectively implemented. In terms of the national strategy the private sector has a particular role to play in developing environmental agreements, in producing sectoral -based waste minimisation guides, and in participating in information networks such as waste minimisation clubs. Such initiatives will benefit greatly from the active participation of trade unions. Other members of civil society will be actively involved in demonstration projects; in ensuring the inclusion of waste minimisation practices in high school and tertiary education curricula; in undertaking relevant research; in promoting membership of waste minimisation clubs; in monitoring the implementation of co-regulatory initiatives

## **2.5 CONCLUSION**

South Africa's population of over 40 million collectively contributes to the 540 million tons of waste produced annually. Historically, most of the waste has been disposed of on land. What has changed, however, is the way in which we manage this waste. The main reason for this is the introduction of graded standards in the Minimum Requirements documents, which in the hands of waste practitioners dramatically changed the face of waste management in South Africa.

This chapter attempted to show the advent and implementation of Minimum Requirements using a holistic waste management and legislative background. The implementation of the Minimum Requirements and the institutional framework is shown in figure 2.1.



**Figure 2: Implementation and Institutional Framework**



## **CHAPTER THREE**

### **CASE STUDY: THE UMLAZI LANDFILL SITE**

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#### **3.1 INTRODUCTION**

This study reviews a specific case that highlights a landfill site in Kwazulu-Natal where a permit was issued to operate according to the Minimum Requirements. The fundamental basis was that the landfill should adhere to these requirements, being minimal as the name suggests, ensuring compliance. The case review thus covers the implementation of the standards strategy, namely the Minimum Requirements strategy that the Department of Water Affairs and Forestry embarked on, in order to improve landfilling in South Africa. The method of study chosen in this case allows the researcher to focus on one case and analyse it, in order to yield valuable information in order to highlight the strengths and weaknesses of the Minimum Requirements policy and more importantly to highlight the degree of compliance and non-compliance of the local authority and the reasons thereto. The Umlazi Landfill site was chosen.

#### **3.2 THE UMLAZI LANDFILL SITE**

Umlazi is an area south of Durban with an estimated 300 000 people living in formal households and up to 100 000 people in informal settlements. Waste is disposed at the Umlazi Landfill site, which is on the perimeter of Umlazi. It was open to urban waste disposal in July 1987. The waste disposal needs of nine residential areas and five industrial areas are served by the Umlazi landfill. The landfill, therefore, plays a strategically important role within the economy of the Durban Functional Region (DFR) and the Kwazulu-Natal Province as a whole. In the DFR the formal waste stream, which has landfill as its ultimate repository comprises approximately 960 000 tons of waste annually. Of this approximately 875 000 tons comprise general urban solid waste (domestic, non-hazardous industrial, commercial, garden refuse and builders rubble), while some 85 000 tons comprise liquid and hazardous waste types which can be safely disposed of to a properly controlled landfill. The Umlazi site accommodates 28% (by

mass) of the general waste and 76.5% (by mass) of the hazardous waste landfilled in the DFR and therefore plays a major role in the disposal of waste in the region. The Umlazi landfill is classified as an H:h site, according to the Minimum Requirements guideline document. It is a large facility containing hazardous waste, generally in the form of liquid wastes co-disposed with non-hazardous general and solid waste. Majority of the site was closed in February 1997 with only a portion of it being operational at present, at the northern tip. At present there is no readily available site (successor) to replace it when it reaches capacity in three years time.

The landfill site created economic benefits in two ways:

- Umlazi utilises the landfill free of charge, in exchange for waiving the rental on the land.
- Several small-scale operators/contractors presently derive a livelihood from collection and transporting Umlazi's general waste to the landfill.

#### **(a) The Physical and Social Environment**

By virtue of its location and prevailing wind direction, the impact zone of the Umlazi landfill extends to the surrounding residential areas, most notably Unit T in Umlazi and Isipingo Hills in Isipingo. Unit T has in the past experienced socio-political upheaval due to rivalries between hostel dwellers and the inhabitants of the nearby informal settlements. Umlazi is relatively impoverished as its residents rely on the informal sector for employment. It is predominantly Black. Comparatively Isipingo residents are significantly better off. In Isipingo there are well-organised voluntary civic and environmental organisations.

#### **(b) Social Issues and Impacts**

1. The landfill is a source of direct employment and the potential exists for more employment opportunities to be developed around the recycling and reclamation of materials from the non-hazardous waste that is delivered to the landfill.

2. Several small scale waste collection and transporting operators serving Umlazi benefit from the landfill as do the retail and trading operators who draw off the markets provided by the waste transporters entering and leaving the landfill.
3. Residents of Umlazi have part of their waste removal costs subsidised whilst residents in Isipingo pay a preferential rate on their waste removal costs.
4. In the absence of a successor site, the Umlazi site fulfils a strategic need within the economy of the Durban Functional Region.

Tangible negative impacts in the form of nuisances caused by odours and dust, which result from the close proximity of the landfill to the surrounding residential areas and the fact that the only access route traverses through a residential area.

**(c) Excerpts from the Permit granted by the Department of Water Affairs and Forestry, in terms of Environment Conservation Act, Act 73 of 1989**

**Permit Number** : 16/2/7/U602/B01/Y1/P246

**Class** : H:h

**Waste Disposal Site** : Umlazi Landfill Site

**Location** : Lot 1435 situated on the Umlazi Reserve Number 8309, District Of Durban

**1. Location**

This Permit authorises the operation, closure and rehabilitation of a waste disposal site on Lot 1435 situated on the Umlazi Reserve Number 8309, District of Durban (hereafter referred to as 'the Site').

**2. Permissible Waste**

The Site may be used for the disposal of general and low hazardous waste types. The Permit Holder shall take all reasonable steps to ensure that no medical waste be disposed of on the Site. No waste originating from any other source, including domestic waste may be disposed of on the Site.

### **3. Permissible Fill Material**

Permissible fill material are material that is normally used in the rehabilitation of landfill sites must be been classified as suitable for disposal at a H:h site according to the Minimum Requirements and must be aimed at achieving the final landform.

### **4. Closure and Rehabilitation**

The Site may not be used for the disposal of fill material once selected for closure and the entire site must be rehabilitated in accordance with the requirements for closure and rehabilitation specified in the Minimum Requirements. The rehabilitation must be undertaken such that the closure construction stage, the deposition of fill material and the implementation of engineering measures to prepare the Site for rehabilitation and the management of impacts during this phase according to conditions stipulated in 3 and 5. The Site must be rehabilitated in such a manner that the community will be able to utilise it for recreational activities. If the Director is satisfied with the closure construction, written confirmation will be given that the construction complies with the Minimum Requirements for closure and that the Site is regarded as closed and rehabilitated.

### **5. Construction**

The Site or any portion thereof may only be used for the disposal of permissible waste if the Site or any such portion has been constructed after approval is sought from the Director and the Professional Civil Engineer. The Permit Holder shall upgrade the Site with the aim to close the Site on the closure date, and rehabilitate the Site accordingly thereafter within the Minimum Requirements and to the satisfaction of the Director and the Monitoring Committee. The Permit Holder can, only undertake any further upgrading, construction, further development or rehabilitation within the Site, after specified engineering plans have been provided to and approved by the Director. The Site must be constructed in accordance with recognised civil engineering practice that meets the requirements of the Minimum Requirements with special consideration to stability. The entire Site must be reshaped in such a manner that the occurrence of erosion is prevented and to facilitate storm-water control. The entire Site must be capped in accordance with the approved plans specified in the Minimum Requirements. The capped

area must be covered with 200 millimetres topsoil, after which it must be vegetated with indigenous vegetation. The slopes of the Site must be constructed and maintained in such a manner that the occurrence of erosion is prevented. The Director shall consult with the Monitoring Committee before any approval is granted. An official of the Department must inspect the completed construction.

#### **6. Storm-water Control Measures**

Storm-water diversion works constructed must be of such capacity as to accommodate all storm-water runoff, which could be expected as a result of the estimated maximum precipitation during a period of 24 hours with an average frequency of once in fifty years. Storm-water containment works constructed to collect contaminated must be of such a capacity as to maintain a freeboard of half of a metre and hold at least two weeks of collected contaminated storm-water. The containment works constructed to collect contaminated storm-water must be lined according to the specifications contained in the Minimum Requirements. The storm-water runoff shall comply with the quality requirements of the

#### **7. Leachate Control Measures**

Deep subsoil leachate interception and blanket drains must be constructed on and around the Site according to the Minimum Requirements to effectively intercept all sub-surface leachate generated on the Site. Surface leachate interception drains must be constructed on and around the Site according to the Minimum Requirements to effectively intercept and drain all leachate generated on the surface of the Site.

#### **8. Landfill Gas Control Measures**

Based on a monitoring systems according to the provisions of the Minimum Requirements, the Permit holder must implement adequate measures to the satisfaction of the Director, to: -

- a. ventilate methane gas generated in the Site by constructing a gas venting system on Site;
- b. prevent the build-up of flammable gas; and
- c. prevent lateral migration of methane gas.

## **9. Maintenance and Impact Management**

The Permit Holder must keep a record of the following details for all loads of permissible wastes disposed of on Site and must report the details regarding the material disposed of on the Site: -

- Source of the wastes;
- Volume of the wastes in cubic metres;
- Physical properties of the wastes (e.g. 5 liquid etc.);
- Chemical composition of the wastes
- Concentration of all chemicals in the wastes;
- Primary classification of the wastes according to the Minimum Requirements;
- Secondary classification of the wastes according to the Minimum Requirements.

The Permit Holder must on a continuous basis, maintain all works constructed on the Site, or any portion thereof, in accordance with the Minimum Requirements. The Site must be maintained in such a way that: -

- the formation of pools due to rain is prevented;
- free surface runoff of rain-water is ensured;
- contamination of storm-water is prevented;
- no objects or materials which may hamper the compaction and rehabilitation of the Site are present;
- the build-up and/or lateral migration of landfill gas is prevented; and
- little or no erosion occurs.

The Permit Holder must prevent access to the leachate collection facilities referred to in condition 11, by having it fenced to a minimum height of 1.8 metres and by installing a gate of minimum height of 1.8 metres at the entrance to reasonably prevent entry of domestic animals, game and unauthorised persons.

## 10. General Operational Measures

- Waste material may not be allowed to burn.
- Waste must be compacted and covered at the end of each working day with a minimum of 150 millimetres of soil or other material approved by the Director.
- The Permit Holder must implement, maintain and at all times apply sufficient dust control measures while on the working phase of the Site is being filled and for the duration during any construction to prevent wind-blown dust from causing nuisance conditions or health hazards.
- The Permit Holder must implement, maintain and at all times apply sufficient odour control measures while on the working phase of the Site is being filled and for the duration during any construction to prevent odours from causing nuisance conditions or health hazards.
- The Permit Holder must implement, maintain and at all times apply sufficient noise control measures while on the working phase of the Site is being filled and for the duration during any construction to prevent noise from causing nuisance conditions or health hazards.
- The Permit Holder shall take all reasonable steps to prevent the disposal of waste on the Site for which the Site has not been approved. The Permit Holder shall only accept waste of which the constituents are known and where the necessary pre-treatment can be implemented on the Site.
- Liquid waste shall not exceed 10% of the total waste volume accepted on the Site. Waste transport and disposal documentation shall specify liquid content as a percentage and shall be verified by the waste generator. Any specific load where the solid content is less than 30% shall be considered as a liquid waste.
- Waste disposed of on the Site may not be reclaimed.
- The Permit Holder shall make use of moveable fences to control wind-blown waste.
- All wind-blown waste within a radius of 200 metres of the Site shall be recovered daily and disposed of on the Site.

## **11. Access Control**

Weatherproof, durable and legible notices in at least two official languages applicable in the area, must be displayed at each entrance to the Site. These notices must prohibit unauthorised entry and state the hours of operation, the name, address and telephone number of the Permit Holder. The Permit Holder must ensure effective access control on the Site by having it fenced to a minimum height of 1.8 metres and by installing gates of a minimum height of 1.8 metres at all entrances to reasonably prevent entry of domestic animals, game and unauthorised persons. The Permit Holder must take all reasonable steps to maintain service roads in a condition that ensures unimpeded access to the vehicles involved in transporting wastes and/or construction activities and must keep these roads free of any waste and/or fill material. The Permit Holder must ensure that all entrance gates are manned during the hours of operation and locked outside the hours of operation.

## **12. Operating Hours**

The disposal of waste may only take place during weekdays between 07h00 and 17h00 and on Saturdays from 07h00 to 13h00. Material deposited on the working phase must be compacted and covered before 18h00 on weekdays and before 14h00 on Saturdays. No machinery shall be in operation on the Site between 18h00 in the evening and 07h00 the next morning. No filling and/or construction activities may take place on Sundays and Public Holidays.

## **13. Storm-water and Leachate Management**

- **Runoff Management:**

All runoff (storm-water) arising as a result of precipitation on the Site and on the land adjacent to the Site must be prevented from coming into contact with any substance, whether such substance is a solid, liquid, vapour or gas, or a combination thereof, which is produced, stored, dumped or spilled on the premises, including leachate and must be diverted and drained around the Site by means of works constructed in accordance with the Minimum Requirements. Uncontaminated runoff water must under no circumstances be used to dilute wastewater resulting from any activities on the Site or leachate



emanating from the Site. All contaminated runoff water may not be discharged into the environment but must be diverted by means of containment works as stipulated in condition 6 of this Permit.

- **Leachate Management**

All leachate produced on Site must be intercepted by means of subsoil and surface leachate interception drains constructed as per condition 7 of this Permit. All leachate in the subsoil interception drains must be diverted to a leachate collection and holding works with sufficient capacity to maintain all storm-water runoff under estimated maximum precipitation conditions. All leachate collected as well as all contaminated runoff water collected must be transported by tanker to a sewage purification works, provided that written proof has been supplied to the director that the authority in control of the works will accept such leachate and bear responsibility for the impact it may have on the operation of this sewage purification works.

#### **14. Water Quality Monitoring**

- **Groundwater Quality Monitoring Network**

The groundwater quality monitoring network must consist of boreholes numbered UM-9 to UM-20, as indicated by the co-ordinates on plan numbered Job 7207, submitted by the Permit Holder, as required by the Minimum Requirements. The Permit Holder must construct monitoring wells in the waste body to monitor the leachate levels in the waste pile as part of the groundwater- monitoring network. The Permit Holder must maintain the groundwater quality monitoring network to the satisfaction of the Director, so that unobstructed sampling, as required in terms of the Permit, can be undertaken. Monitoring boreholes must be equipped with lockable caps. The Department reserves the right to take water samples at any time and have them analysed.

- **Surface Water Quality Monitoring Network**

Background monitoring of surface water quality must be conducted during each monitoring occasion on the upstream of the Site in the Isipingo River. Monitoring of the impact of the site on the surface water quality must be conducted in the Isipingo River downstream of the Site or at any other location, which may be identified by the Director,

which shall be downstream of the Site. Monitoring of storm-water and leachate quality must be conducted during each monitoring occasion or at any other location, which may be identified by the Director.

- **Frequency of water Quality Monitoring and Variables for Analysis**

Monitoring of the groundwater quality network must be conducted: -

1. Monthly for the rest level of water in the monitoring boreholes and wells.
2. Quarterly for the variables listed in Annexure II; as well as
3. Bi-annually during the months of September and March, for the additional variables listed in Annexure III.

Monitoring of the surface water quality network must be conducted: -

1. Monthly for the variables listed in Annexure II, as well as
2. Bi-annually during the months of September and March, for the additional variables listed in Annexure III.

Monitoring of uncontaminated runoff water quality must be conducted for the variables specified in Annexure I during each monitoring occasion: -

1. in all storm-water drains and containment works on and adjacent to the Site; and
2. in the unnamed tributary of the Isipingo River in the valley downstream from the point where uncontaminated runoff water is being discharged.

Any leachate that may be produced on the Site or contaminated runoff water must be monitored monthly or at a frequency determined by the Director for the following: -

1. Volume produced; and
2. the variables specified in Annexure II and III.

Monitoring of treated leachate and/or contaminated runoff water which are discharged into the environment, must be conducted annually for any other variables which are not covered by Annexure II and Annexure III, but which are listed in the Minimum Requirements.

## **15. Air Quality and Gas Monitoring**

The Permit Holder shall implement measures according to the Minimum Requirements and the satisfaction of the Director, to ventilate or to prevent lateral migration of methane gas generated in the waste disposal area within the Site so that the build-up of dangerous concentrations is prevented.

Monitoring of flammable gas must be conducted: -

1. through the network of boreholes as indicated by the co-ordinates on plan numbered Job 7207, submitted by the Permit Holder, as required by the Minimum Requirements.
2. in the atmosphere inside the buildings on the Site,  
for the quantitative detection of the following volatile materials on the Site:-
  3. carbon dioxide;
  4. methane;
  5. total volatile organic carbons; and
  6. benzene.

The atmospheric levels in the atmosphere of

1. carbon dioxide must not exceed 0.5%; and
2. methane must not exceed 1%.

Should the atmospheric levels of flammable gas be between 0.1% and 1%, a higher frequency of monitoring must be instituted. Should levels above 1% be detected in buildings on the Site, the buildings must be evacuated and the contingency plan must be implemented immediately.

Should the measurements of the gas-monitoring network at any time exceed the limits specified for the carbon dioxide and methane above, the Permit Holder must report this as an incident.

## **16. Audits and Inspections**

The Permit Holder must conduct monthly inspections on the Site, during which the following must be inspected and maintained where necessary: -

- Integrity of the storm-water and leachate systems;
- Occurrence of erosion on the capped surface;

- Integrity of vegetation established as part of the landfill site;
- Level of leachate in the leachate collection sump;
- Odours, noise and dust;
- Security

The Department reserves the right to audit and/or inspect the Site at any time and at such a frequency as the Director may decide, or to have the Site audited or inspected.

The Permit Holder must make any records or documentation available to the Director on request, as well as any other information the Director may require.

### **17. Monitoring Committee**

The Permit Holder must take all reasonable steps to maintain and ensure the continued functioning of the Umlazi Landfill Site Monitoring Committee (herein referred to as the 'Monitoring Committee') during the operation of the Site and for a periods of at least two years after the closure of the Site, or such longer period as may be determined by the Director.

The Monitoring Committee shall be representative of relevant interested and affected persons and may consist of the at least the following parties

- Permit Holder and/or his appointed consultant(s) or advisor(s);
- Representative(s) of the Health, Environment and/or Waste Departments of the relevant local authority
- Representative(s) of this Department;
- Representative(s) of the Provincial Government responsible for waste management and environmental matters; and
- At least three persons/parties from the local community and/or their representatives elected by the local residents and/or their appointed consultant(s) or advisor(s).

### **18. Reporting of Incidents**

The Permit Holder must, within 24 hours, notify the Director of the occurrence or detection of any incident at the site, or incidental to the operation of the Site, which has the potential to cause , or has caused water pollution, pollution of the environment, health risks or nuisance conditions or which is a contravention of any permit condition.

The Permit Holder must, within 14 days, or a shorter period of time, if specified by the Director, from the occurrence or detection of any incident referred to above, submit an action plan, which must include a detailed time schedule, to the satisfaction of the Director of measures taken to: -

- correct the impacts resulting from the incident;
- prevent the incident from causing any further impacts; and
- prevent a recurrence of a similar incident.

**Annexure I: Water Quality Requirements to which Uncontaminated Runoff water must comply before Discharge into the Environment**

<b>Determinant</b>	<b>Value</b>
pH	6.0-9.5
Electrical Conductivity (mS/m)	150
Chemical Oxygen Demand (COD in mg/l)	75
Manganese (Mn in mg/l)	0.3
Sulphate (SO <sub>4</sub> in mg/l)	250
Chloride (Cl in mg/l)	150
Calcium (Ca in mg/l)	50
Sodium (Na in mg/l)	150
Ammonia (NH <sub>4</sub> in mg/l)	5

## Annexure II: Water Quality Variables Required for Monitoring

Variables	Variables
Alkalinity (as mg CaCO <sub>3</sub> /l)	Mercury (Hg)
pH	Magnesium (Mg)
Electrical Conductivity (EC)	Total free cyanide (CN)
Chemical Oxygen Demand (COD)	Volatile organic carbon (VOC)
Manganese (Mn)	Total phenolic compounds (Phen)
Cadmium (Cd)	Soluble ortho phosphate (PO <sub>4</sub> -P)
Chloride (Cl)	Potassium (K)
Calcium (Ca in mg/l)	Sulphate (SO <sub>4</sub> )
Sodium (Na in mg/l)	Nitrate (as N) (N O <sub>3</sub> -N)
Free and saline ammonia N(NH <sub>4</sub> -N)	

## Annexure III: Water Quality Variables required for Bi-Annual Monitoring

Variables
Arsenic (As)
Boron (B)
Chromium (hexavalent) (Cr <sup>6+</sup> )
Chromium (total) (Cr)
Copper (Cu)
Dissolved organic carbon (DOC)
Total dissolved salts (TDS)
Fluoride (F)
Iron (Fe)
Lead (Pb)
Volatile organic hydrocarbons (VOH)
Zinc (Zn)

#### **(d) A Situation Analysis: Audit of the Landfill Site**

Audit reports reveal the following problems that are experienced with the operation of the site: -

- High salinity of leachate was detected. Increasing salinity cause problems for any leachate treatment. Wide discrepancies in arsenic concentrations have also been observed.
- The leachate collection drains that separate storm-water and leachate have become blocked due to the leaching of fine soil.
- Management of contaminated storm-water drains requires urgent attention as does solids removal from the leachate sump. They were badly scoured resulting in solids accumulation in the leachate sump thereby reducing its capacity.
- The level of liquid acceptance in relation to permitted leachate discharge does not correlate.
- Cover was inadequate at the working face where wastes were dumped due to the large liquid effluent. The leachate storage dam was overflowing due to the large liquid content and the heavy rainfall events.
- Contaminated storm-water and leachate is stored in a dam at the head of the site. High potassium levels confirm the presence of pollution, just below the dam.
- Contaminated groundwater migrating down slope from the site is not contained, suggesting the liner has become porous.
- Some of the boreholes are seriously polluted by leachate with high concentrations of COD, ammonia, salinity, potassium and sulphates. The problem of arsenic and cyanide levels in leachate still persists.
- A pollution plume based on the highly mobile chloride chemical analyte in the vicinity of the waste piles.
- Unauthorised delivery of medical waste to the site is occurring.
- Landfill gas levels are not checked on a regular basis. Gas migration has been observed to occur. Readings of barometric pressure and temperature are not taken. Methane levels are observed to be hovering around the 40% mark.
- A number of gas wells, probes and vents are not functioning.

- In terms of security, the perimeter security fence has been breached in several places. There were no warning signboards and some parts of the fence were missing.
- During periods of heavy rainfall, storm-water falling on uncapped portions is being polluted. Storm water falling on the land adjacent to the Site is flowing into the Site. Storm-water contaminated by leachate, during heavy rainfall events emerging from the landfill surface slopes on the south side of the site, flows across the roads into the environment. On the western side of the Site, the contaminated storm-water runoff flows into the Isipingo River.
- Runoff is being diverted away from the catchpits that were constructed for containing the storm-water. Some pits were blocked with waste debris and soil.
- Plastic sheets over trenches were causing ponding of runoff water. This further exacerbated the contamination of runoff water.
- A new lined waste disposal cell had been designed and constructed, however landfilling operations were terminated before the void could be filled and rehabilitated. This uncompleted cell poses an ongoing environmental problem with erosion of the steep excavated sides and the unsightly void.
- The liner that was used in the new cell was found to be unacceptable.
- The use of hydrogen peroxide to pre-treat the waste was not acceptable, as it caused the accumulation of determinants like COD, conductivity, ammonium nitrogen, sulphates and heavy metals.
- Stockpiles of drummed agricultural wastes are stored on Site. Many of the drums appeared to contain pesticides or chlorinated hydrocarbons and were damaged and leaking.
- Unpleasant odours are a problem on this Site and the odour gets stronger on nearing the Site. The odour follows the migration of the leachate down the Isipingo Valley and detected almost 2km away.
- The landfill surface has a layer of cover of varying thickness, not necessarily 150mm thick.
- The upper surface of the landfill is described as dome-shaped and the southern slope is a series of small stepped terraces. These exposed in-situ slopes erode as a result of rainwater impinging on and flowing down the slopes.



- Alternate wetting and drying of this face causes swelling and shrinkage, which leads to progressive ravelling and deterioration of the slope face.
- Trenches for co-disposal of liquid were cut as deep as possible into close to the working cell. There was a strong odour from the excavated waste.
- Substantial areas of uncovered waste were visible. This was due to heavy rainfall events and inadequate compaction.
- Only one mobile compactor was functioning on a Site of this magnitude. The other compactor was removed due to its unsuitability for use on this Site and the other compactor was out of service for repair.
- Complaints were received from nearby residents regarding the odours, noise, flies and dust. Windblown waste was scattered far beyond the perimeter fence.
- Evidence was observed that scavenging had occurred.
- Ongoing complaints were received about the location of the landfill site and the lack of community consultation. There has been a negative reaction to the operation of the landfill by members of the surrounding community.

### 3.3 CONCLUSION

This chapter presented a background of the Umlazi Landfill Site, the legally enforceable Permit and the audit findings as a case study. It was evident that there are significant deviations from the conditions as stipulated in the Permit. The next chapter will evaluate these deviations and attempt to explain the reasons thereto.

## CHAPTER FOUR EVALUATION AND DISCUSSION

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### 4.1 INTRODUCTION

This chapter evaluates the case study and discusses the findings of the study on the effectiveness of the implementation of the Minimum Requirements, as stipulated in the Permit. The decision to include the same Minimum Requirements was to set graded standards in landfilling in South Africa and to improve waste management at waste disposal facilities. The incentive was to bring landfilling in South Africa to First World standards and practices. The evaluation of the case study will attempt to highlight the areas of compliance versus non-compliance of the Site with the Permit conditions and the reasons thereto.

### 4.2 EVALUATION

Having set out the situation analysis of the Umlazi Landfill (where we are now scenario), as well as the conditions of the Permit, in accordance with the Minimum Requirements (where we would like to be) in Chapter Three, this section evaluates the degree of compliance versus non-compliance. Interviews with the Manager on the Site, Site Engineer, Departmental Officials, Academics and independent waste management Consultants shed further insight into the reasons for non-compliance with the Permit conditions.

The following conditions were in breach of the Permit, and, by implication, non-compliance with the Minimum Requirements and the reasons thereto: -

- **Inadequate Leachate Management**

**The Minimum Requirements state:**

To avoid water and environmental pollution, it is essential that significant leachate generation from landfills be managed by means of leachate collection and treatment

systems. All hazardous waste landfills are assumed to require leachate management systems. Any landfill has the capacity to generate leachate in excessively wet weather conditions. It is only necessary, however, to install leachate management systems (underliners, drains and removal systems) when leachate generation could impact adversely on the environment. Significant leachate requires to be managed by means of a proper leachate management system. Significant leachate generation may be either seasonal or continuous throughout the year. It results mainly from climate and/or waste with a high moisture content. In the case of existing landfills that do not meet the Minimum Requirements, other factors may also exist. These include fundamental problems with the landfill siting and/or drainage, which result in significant ingress of ground or surface water into the waste body, and hence significant leachate generation.

In H:h landfill sites, significant leachate is generated and leachate management is mandatory. The design for such sites will include a leachate management system. As with the drainage system, however, the leachate management system requires to be maintained and continuously adapted and developed, as the landfill develops. Where treatment is involved, a whole separate operating procedure must also be adhered to. Leachate management is necessary in the case of H:h waste disposal sites, where significant leachate is generated. The design includes a liner underlying the site, as well as leachate collection and treatment measures. The leachate treatment system will depend on the leachate composition and on the most appropriate method of treatment. This could be on-site chemical, physical or biological treatment, and/or off-site treatment where leachate is passed into a sewer or pipeline for treatment elsewhere. It is a Minimum Requirement that all hazardous waste have leachate treatment facilities acceptable to the Department.

For significant generation of leachate, it is required that two geo-membrane liners are required in the liner. These more stringent requirements are set because the hazardous waste in a lagoon is not dispersed, absorbed and ameliorated by dry general waste.

**Reasons for Non-Compliance:** The costs are excessive in maintaining such a management system once it is set-up. The topography of the Site and the working faces are different at each phase, to adequately implement this system. Personnel on Site are not familiar with the types of leachate-generating wastes. The liquid content of wastes

disposed of at the Umlazi Site is more than that of solid wastes and the capacity of leachate dams and sumps are exceeded in such circumstances. The Sewage Treatment Works cannot handle the quantities of leachate generated on this Site. To effectively pre-treat leachate is not a financially feasible option. Heavy rainfall events cannot be predicted accurately and are regarded as extraneous variables. Water percolates rapidly through fine soil, resulting in copious amounts of leachate. The liners required to stop the leachate from contaminating the soil are very expensive and double-liners are required, which adds to the expense.

- **Inadequate Containment of Surface Water Runoff**

**The Minimum Requirements state:**

Upslope run-off water must be diverted away from the waste, to prevent water contamination and to minimise leachate generation. Where contaminated water or leachate does arise on a site, it must be managed. This means that it must be kept out of the environment. This also applies to the drainage from wash bays and spills at hazardous waste landfills. Clean, uncontaminated run-off water must not be permitted to mix with, and increase the volume of contaminated water. Upslope cut-off and toe drains must be in place before the landfill is commissioned. The following are Minimum Requirements:

Run-off and storm water must always be diverted around one or both sides of the waste body, by a system of berms and/or cutoff drains. Water contaminated by contact with waste, as well as leachate, must be contained within the site. If it is to be permitted to enter the environment, it must conform or be treated so as to conform to the Special or General Effluent Standards in terms of the Permit. The bases of trenches and cells must be so designed that water drains away from the deposited waste. Alternatively, cells must be so orientated as to facilitate drainage away from deposited waste. The resulting contaminated water, together with all other contaminated run-off arising from the landfill, must be stored in a sump or retention dam. It may be pumped from the dam and disposed of if it conforms to the Special, General or Specific Effluent Standards stipulated in the Permit. A 0,5m freeboard, designed for the 1 in 50 year flood event, must always be maintained in the case of contaminated water impoundments and drainage trenches. All temporarily and finally covered areas must be graded and maintained to promote run-off

without excessive erosion and to eliminate ponding or standing water. Clean, uncontaminated water, which has not been in contact with the waste, must be allowed to flow off the site into the natural drainage system, under controlled conditions. All drains must be maintained. This involves ensuring that they are not blocked by silt or vegetation. Surface hydrology design will include surface drainage and storm water diversion drains, to meet the requirements of the National Water Act, Act 36 of 1998. This includes the separation of unpolluted from polluted surface water and the containment of polluted water on site in impoundments. Also, where leachate is generated, it must be contained separately from water, which is only slightly polluted through contact with the waste resources. Appropriate topocadastral data must be provided. This must include all significant topographic features. Most important are the drainage patterns, including seasonal and perennial streams and the distances to the nearest important water- courses, wetlands and rivers. Rock outcrops and surface soil must also be recorded here. The drainage systems must be designed to must divert or contain the peak design storm of 50-year return period for the particular catchment area. The system must effectively separate unpolluted water that has not come into contact with waste, from polluted water. The upslope cut-off drains must divert clean storm-water around the site and into the natural drainage system. Polluted water, on the other hand, must be collected in toe drains, retained on the site and managed in accordance with the Department's directives. It is essential to ensure that drains are not excessively eroded or filled with silt or vegetation. They must function in order to ensure that excess surface water does not enter the waste body.

**Reasons for Non-Compliance:** Topography of the Site does not lend itself to building containment drains that can divert all of the surface-water runoff generated. Drains were built to try and contain as much of the runoff as possible. This Site was in operation prior to the publication of the Minimum Requirements. It was felt that runoff being diverted into the Site from the road surfaces and adjacent land was beyond the control of the Site operation. Financial viability was also mentioned as a reason. The Site Engineer felt that the present drainage system and the dam to capture the runoff, was sufficient. With respect to the silted drains and erosion of drains, they were eventually cleared and

repaired. This could not be done immediately due to more urgent priorities and lack of staff.

- **Contamination of Ground- and Surface Water Management**

**(The Minimum Requirements stated above also apply here as well).**

**The Minimum Requirements state:**

The Permit Holder must ensure regular sampling and analysis of leachate, ground and surface water, and the interpretation of such findings. Records must be maintained of any impact caused by the landfilling operation on the quality of the water regime in the vicinity of the site. In terms of the Permit conditions, the Department requires this. Additional samples may be taken at other times, if this is considered necessary. During the site investigation, surface water quality in any associated drainage feature is monitored both upstream and downstream of the proposed landfill. Sampling points must be selected at representative, easily identified sites. While a single upstream sampling point may suffice, the size and complexity of the site, i.e. its class, will determine the number of downstream sampling points required. The sampling points downstream of the proposed landfill will ultimately indicate any pollution resulting from the site. For consistency and for comparative purposes, the same water quality parameters are analysed for in both surface and ground water monitoring. The ground water monitoring system, and the treatment and storage of samples are those advocated by Weaver in 'Groundwater Sampling'. [Ref. Weaver, J.M.C., *Groundwater Sampling*. Water Research Commission Project No. 339 TT 54/92.] Surface water sampling methods are somewhat simpler, however, in that grab samples may be taken from the surface water sampling points. Once a landfill is operational, water monitoring for level and quality must take place in accordance with the Permit Conditions and any subsequent requirements that the Department may have. Operation monitoring involves monitoring the water regime in the vicinity of the landfill. Monitoring may include the sampling and analysis of surface water, ground water and leachate. The above systems may, however, have to be expanded to accommodate changed circumstances. The impact of the landfill on water quality is assessed by making a comparison between the pre-disposal, up gradient, or ambient background, and the down gradient concentrations monitored. This will indicate whether

there is a pollution problem due to contaminated surface water or leachate leaving the site. Where complex situations are involved, a specialist should be consulted.

**Reasons for Non-Compliance:** Clogged and insufficient drainage systems lead to the surface water leaving the Site and discharging straight into the environment, as they cannot cope with the volume. Runoff mixing with leachate is another consequence of this. Samples collected take a long time to be analysed before a pollution trend is detected. Boreholes become blocked and clogged due to waste debris and/or soil/silt after heavy rainfall events. Additional boreholes are costly to sink and sometimes the geo-hydrology is not suitable to do so. Inappropriate sample collection procedures could also lead to inaccurate analyses, as staff are not trained adequately or do not take the task seriously or they are not done timeously. Due to large amounts of liquid wastes, the working face is wet and runoff also mixes with this effluent. Integrity of the liner may be compromised and leads to leachate mixing with groundwater hence causing pollution. This pollution plume may be difficult to detect unless geo-hydrological studies are done regularly. Again, this entails huge financial outlays, as specialist expertise is expensive.

- **Ineffective Gas Monitoring System**

**The Minimum Requirements state:**

Landfill gas has a distinctive and unpleasant odour, which is frequently the reason for complaints by Interested and Affected Persons. Landfill gas can, however, also result in an explosion hazard, where methane gas reaches concentrations of between 5% and 15% of atmospheric gas composition. The risk of gas explosion must therefore be continually monitored. If monitoring indicates that there is any safety risk on account of landfill gas accumulation and/or migration, controls must be considered in consultation with the Department. While gas monitoring is a Minimum Requirement at a H:h site, monitoring systems must be installed whenever potential gas problems exist. If the soil gas concentrations exceed 1% by volume at Standard Temperature and Pressure (STP), the Department must be informed. Methane concentration in the atmosphere inside buildings on or near the site should not exceed 1% (by volume) in air, i.e. 20% of the Lower Explosive Limit (LEL). If the methane levels are found to be between 0,1% and 1% in air

(i.e. between 2% and 20% of the LEL) then regular monitoring must be instituted. If levels above 1% (i.e. 20% of LEL) are detected, then the building must be evacuated and trained personnel consulted. Methane levels on landfill boundaries should not exceed 5% in air (i.e. the LEL). This should apply to the air above the surface and also to the air in a hole dug into the earth on the boundary. If the methane levels are found to be between 0,5% and 5% in air (i.e. between 10% of LEL and LEL) then regular monitoring of the boundary should be instituted. If the methane levels are found to be greater than 5% in air then a permanent venting system should be implemented. Apart from explosion potential, however, landfill gas also contains a wide range of volatile organic compounds that are classified as hazardous air pollutants. Where significant landfill gas is present, therefore, samples must be taken at various positions at the landfill site, and characterised for volatile organic compounds. Sampling can be direct at gas wells. The volatile organic compound compositions of the landfill gas must then be subjected to occupational and environmental health risk assessments. This must be done at the discretion of the Department to ensure against unacceptable health risks to workers or communities. Gas monitoring should continue after landfill closure, until the Department is satisfied that landfill gas no longer represents a risk.

**Reasons for Non-Compliance:** The gas wells, probes and vents were imported from an overseas supplier. It became an expensive exercise to send the equipment to the supplier to repair. It was more feasible to await a technician from the company to come to South Africa. Some of the technology has become outdated and the components are not available and some need upgrading.

- **Unacceptable Medical Waste**

**The Minimum Requirements state:**

The disposal of medical wastes at any landfill site is prohibited. (At this Site this is not allowed as one of the Permit conditions). Incineration of medical waste is a prerequisite to disposal. The ash must be disposed of under dry conditions at an approved hazardous waste site, unless negotiated otherwise with the Department .In the event of an emergency, and in the interests of public health and the environment however, the



Department will consider applications for the disposal of medical waste into a specially constructed dry cell within an approved site. Such disposal would be under controlled conditions and for a limited period of time, and it is a Minimum Requirement that the Department be approached. In the event that medical wastes are intercepted at either a general or a hazardous waste landfill site, it is a Minimum Requirement that the Responsible Person or the Permit Holder immediately contact the Department for a directive in this regard.

Reasons for Non-Compliance: The Site Manager is not aware of any medical wastes entering the Site. It was conceded that the Security may have been lax and that the procedures for checking all wastes were not followed adequately. It was mentioned that medical wastes could have been mixed with the other accepted waste types and was hard to detect.

- **Lack of Adequate Compaction**

**The Minimum Requirements state:**

Compaction of waste is generally achieved by passing heavy equipment over deposited waste. This reduces voids in the waste, thus reducing the chances of channelling which promotes the rapid infiltration and migration of any leachate formed. It also reduces the risk of fires, discourages vermin, controls litter, reduces the amount of cover required and increases site life. Compaction is best achieved if the waste is spread in thin layers and compacted by a purpose-built landfill compactor. This compaction procedure is a Minimum Requirement at H:h waste disposal sites. It is a Minimum Requirement that daily or periodic cover be sufficient to isolate the waste from the environment. A minimum thickness equivalent to the effective covering of 150mm of compacted soil is required. This thickness may, design should be presented to and discussed with the Interested and affected Persons, in order to inform them and to obtain any further input that might be forthcoming. The compaction properties for any soil or modified soil proposed for use in lining or capping layers must be established according to the Standard Proctor Compaction Test. Where appropriate, shear strength testing of soils must be performed to enable the overall stability and the permissible angle of cut slopes to be

assessed. This is especially the case where extensive cut slopes or trench systems are envisaged.

**Reasons for Non-Compliance:** Some of the Compactors were unsuitable for the terrain on the Site. Some were broken and were to be repaired. Since they were sourced from overseas suppliers, and they needed to be sent back to them for repair. This is an expensive exercise and leads to time delays. No such compactors were available for hire, here in South Africa. The Site Manager was unaware if any soil suitability tests were carried out and uses the soil on Site to compact and cover.

- **Inadequate Cover Material**

**The Minimum Requirements state:**

As the proper landfilling of waste requires regular covering to isolate the waste from the environment, landfills should be so sited and designed that sufficient cover is conveniently available for the duration of the operation. Any cover excavations must also be planned to ensure an adequate separation between the waste and the ground water regime once the soil has been removed. The sanitary landfill definition specifies daily cover. It is therefore a Minimum Requirement that the waste be fully covered at the end of each working day. The sanitary landfill definition specifies daily cover. It is therefore a Minimum Requirement that the waste be fully covered at the end of each working day.

Most sanitary landfill operations are based on a series of trenches or cells which are prepared to receive the waste. Waste is deposited in trenches or cells, spread, compacted and covered, so that each day's waste is effectively isolated from the environment. The material to be used for cover may be on-site soil or builders' rubble. With the approval of the Department, ash or other artificial covering can be used. In all cases, a strategic stockpile of cover, enough for at least three days, should be maintained close to the working face for use in emergencies. Suitable equipment and resources must also be available to ensure that there is sufficient cover material, so that no area is left uncovered at the end of the day's operation. It is a Minimum Requirement that daily or periodic cover be sufficient to isolate the waste from the environment. A minimum thickness equivalent to the effective covering of 150mm of compacted soil is required. This

thickness may, however, have to be increased in the case of poor quality cover. If the area is to be left for an extended period, but ultimately to be covered again with waste, the compacted thickness of this intermediate cover must be increased to 300mm. This is not as thick as final cover, but affords the additional protection required in the longer term.

**Reasons for Non-Compliance:** The soil on the Site is fine and can erode easily. Cover of varying thickness results due to leaching of soil and erosion. This leads to the problem of waste being uncovered and appears uncapped. Due to the liquid content of wastes disposed on this Site, this also leads to the easy wetting of the soil.

- **Inappropriate Lining Systems**

**The Minimum Requirements state:**

Where excavated areas require lining, the side slopes should be such that it is possible to lay the required liner. Some geo-membranes have a low interfacial friction with soil, as well as with waste. Any inclined surface covered by a liner incorporating a geo-membrane must be investigated for possible interlayer slippage. This could be slippage of the geo-membrane on its supporting layer, slippage between the geo-textile and a protective geo-fabric, or slippage of a soil protective layer overlying the geo-membrane. Designs should also take into account the effects of pore pressure arising from an accumulation of liquid or leachate above the liner. Geo-membrane liners (sometimes referred to as flexible membrane liners or FMLs) must comply with the requirements of SABS Specification 1526 Type I geo-membranes. Geo-membranes, composite liners and geo-textiles (or geo-fabrics) will have to be tested for strength, interface friction, durability and compatibility with identified components of waste and leachate. Depending on the details of the proposed landfill, the Department may call for additional performance criteria. Because of potential clogging by biological slimes and chemical precipitation, geo-textiles through which landfill leachates must seep, should be used with caution. Testing and quality assurance of geo-synthetic liners are Minimum Requirements in the case of H:h waste disposal sites. Any geo-membrane used in a capping layer should also comply with the requirements of SABS Specification 1526 Type III geo-membranes to ensure that strains due to settlement of the waste body are

accounted for. A mandatory physical separation between the waste body and the groundwater regimes is fundamental to all designs. Because of the potential toxicity of leachate, sites that generate significant leachate require leachate management, which involves the construction of liners. Similarly, adopting the Precautionary Principle, the Minimum Requirements require minimal liners at H:h landfills. In the case of H:h sites the Minimum Requirements require a substantial liner and leachate management system to be provided. Liners for H:h sites are composite clay and geo-membrane liners. Every liner system is made up of a series of elements that can be assembled in various ways to provide the necessary degree of protection to the ground water system.

**Reasons for Non-Compliance:** The liner that was utilised in the new cell was thought to have been appropriate by the Site Engineer, at the time. Double liners were thus not utilised. There is no leakage detection system in place on Site that could have suggested slippage of the liner, which resulted in leachate polluting the groundwater.

- **Complaints of nuisances like noise, odour, flies and dust**

**The Minimum Requirements state:**

It is a Minimum Requirement that all litter be contained within the site. This may be achieved by applying the sanitary landfill principles of compaction and cover. On sites characterised by high winds, however, movable litter fences are a Minimum Requirement. Windblown litter must be picked up and removed from fences and vegetation on a daily basis. Odours must be combated by good cover application and maintenance. Furthermore, the prompt covering of malodorous waste to reduce odour problems is a Minimum Requirement. In extreme cases, odour suppressants such as spray curtains may be required. Where breaches in the cover from which significant volumes of landfill gas escape are identified by their odour, proper investigation is a Minimum Requirement. This may be followed by properly engineered passive or active gas venting and flaring, to alleviate odour problems. All equipment used on site must conform to the local authority's by-laws concerning noise levels and hours of operation. In the absence of by-laws, national regulations on noise control must be complied with. It is a Minimum Requirement that landfill sites be kept free of vermin. Appropriate measures must be

taken to eliminate or minimise disease vectors such as rats or flies. Unsurfaced roads and ungrassed or unpaved areas, which give rise to dust problems, must be regularly watered to restrict dust to levels which do not pose a nuisance to workers or users of the facility. At all landfills there is some risk of dust and the escape of contaminants by wind action. Hazardous air pollutants may therefore be dispersed from a landfill site as dust, or as gaseous substances. These have to be monitored separately. Because of many sources of dust and variations in wind characteristics and other meteorological parameters, ambient air monitoring for dust concentrations at landfill sites has limitations. It is preferable to characterise the possible sources of dust on the landfill site in terms of hazardous metals, anions, and semi-volatile organic compounds that are normally particulate-associated, and then to model dispersion. This approach entails sampling of dust that can be suspended, using a sampling approach that would ensure statistically that samples are representative of all possible sources of hazardous substances. Chemical analyses must cover all substances that may be relevant to the materials and activities, using validated methods in a formal quality assurance structure. The Department may request analyses of dust sources, followed by mathematical dispersion modelling and human health risk assessment, at more frequent intervals if hazardous substances are present at levels that may lead to unacceptable health risks to workers or communities.

**Reasons for Non-Compliance:** The flies and odours are as a result of the uncovered waste and the leachate. Reasons given for uncovered waste and spillage of leachate into the environment were given previously. The use of spray curtains to curtain malodorous odours is an expensive option and hence the reason to go for the treatment of the leachate instead. The treatment process, as stated earlier is not the most effective. The access roads to the Site are sprayed once a day to help combat the dust problem and this is thought to be adequate. Noise is to be kept at a minimum and work is confined to the operating hours. It was felt that some complaints were invalid and were politically motivated.

- **Inadequate Security**

**The Minimum Requirements state:**

Signs in the appropriate official languages must be erected in the vicinity of the landfill, indicating the route and distance to the landfill site from the nearest main roads. These traffic signs must conform to the requirements of the Road Ordinance. Suitable signs must also be erected on site, to direct vehicle drivers appropriately and to control speed.

A general notice board must be erected at the site entrance. This must also be in the appropriate official languages, stating the names, addresses and telephone numbers of the Permit Holder and the Responsible Person, the hours of operation, and an emergency telephone number. It is of particular importance that the sign clearly states the class of landfill and the types of waste that can be accepted. Wastes that cannot be accepted must also be stated. It must be stated that disposal of non-acceptable waste types is illegal and can lead to prosecution. In the case of hazardous waste landfills, clearly visible signposts warning of the associated hazards must be erected along the fence line at intervals not exceeding 100m. In addition to access control, suitable security must be provided to protect any facilities and plant on site. It is a Minimum Requirement that unauthorised pedestrian access be strictly prohibited at hazardous waste disposal sites, although this may be difficult in some instances. Primarily for the purpose of protecting public health and safety, waste reclamation and squatting should be discouraged. It is a Minimum Requirement that no reclamation is allowed at hazardous waste disposal sites. Since fencing is not always effective, additional measures may be necessary in order to achieve this Minimum Requirement.

**Reasons for Non-Compliance:** The site is manned 24 hours a day, but being a large site it is a difficult exercise to patrol the entire boundary. Police have been informed about the vandalism of signboards and theft of fencing as well as the scavenging activities but this is again a futile exercise as it is difficult to apprehend those responsible.

- **Lack of Public Participation**

**The Minimum Requirements state:**

When the Minimum Requirements were first published in 1994, public participation in the development of landfills was an arbitrary process and there were no authoritative guidelines. In 1996, however, the Constitution was published. In terms of Sections 24 and 32 of the Bill of Rights, and because of public demand, public participation in landfill development projects became mandatory, even though no regulations or guidelines existed. These were, however, provided by the EIA Regulations (EIAR), which were promulgated in Government Gazette No. 18261, 5th September 1997. Guidelines were published in April 1998 [Ref: DEAT: *Guideline Document, EIA Regulations, Implementation of Sections 21, 22 and 26 of the Environment Conservation Act*, Pretoria, 1998.] The inclusion of public participation in the Minimum Requirements for the development of landfills is based on constitutional law and the EIA regulations. Entrenched in our Constitution is the requirement that the public be consulted and informed of any development that may have an effect on their quality of life. In terms of Section 20 of the Environment Conservation Act, 1989, waste disposal is an activity that may have a substantial detrimental effect on the environment. It is therefore subject to the EIA process.

**Reasons for Non-Compliance:** This Site was established prior to the promulgation of the Minimum Requirements and the mandatory Public Participation Process. However, the establishment of a Monitoring Committee hopefully will accommodate and facilitate liaisons between the government, private and public sector. The Permit Holder is of the opinion that some of the complaints on site selection and suitability are irrelevant at this point in time but due to the sensitive political nature of the location of the site, could get the Site declared as unsuitable and hence closed. (This did indeed happen when certain sections were closed the then Minister of Water Affairs and Forestry, Minister Kader Asmal, due to political pressure of the community).

- **Disposal Limits Exceeded**

There is no limit stipulated per se in the Minimum Requirements regarding disposal limits in the Minimum Requirements of H:h sites.

**The Minimum Requirements state:**

Co-disposal refers to the mixing of liquid and dry wastes or to the mixing of general and hazardous wastes. Liquid wastes may be co-disposed with dry waste in order to soak up excess liquid and to avoid pool formation or unauthorised lagoon situations. In order to regulate the practice of co-disposal, it is a Minimum Requirement that documentation be drawn up describing the waste load allocations and liquid co-disposal ratios. An operating procedure and a Response Action Plan, suitable for the hazardous waste disposal operation under consideration, are also Minimum Requirements. Any landfill where the co-disposal of liquids is permitted requires to be lined and equipped with a leachate management system, which can contain, extract and preferably treat the resultant leachate flow. Liquid wastes may be co-disposed by end tipping into trenches excavated into the waste body, or into engineered cells containing predominantly solid waste. The co-disposed waste is subsequently covered with dry general waste, which may also be end tipped. It is a Minimum Requirement that, by the end of the working day, there is sufficient dry waste in the cell to permit vehicle compaction and covering activities. There must be no pooling or free liquid surfaces, which create odours and possibly air pollution. In order to achieve this, an appropriate solid/liquid waste co-disposal ratio is required. Where trenches excavated into the waste body remain filled with liquid, they must be secured and covered by a constructed frame cover.

**Reasons for Non-Compliance:** There was no need to calculate any co-disposal ratio as the Site was established prior to the promulgation of the Minimum Requirements. Sufficient cover material and general waste were thought to be adequate to compact the liquid wastes. The financial implications of rejecting the acceptance of the liquid wastes meant a substantial loss in revenue, being the primary source of revenue-generation. The general waste is minimal compared to the liquid counterparts hence covering was not



adequate. Thus some of the working faces appeared wet. There is no weighbridge to accurately determine the volumes of the wastes.

### **4.3 DISCUSSION OF FINDINGS**

#### **4.3.1 Introduction**

The evaluation of the case study revealed a common thread in the areas of non-compliance. Underlying this and what was said at the interviews with the various stakeholders it was felt that the Minimum Requirements were too stringent and disadvantaged already established landfill sites in the pre-standards era. This section will attempt to discuss the findings in greater depth in order to ascertain the reasons for non-compliance. Care must be taken to differentiate between the sophisticated first world approach that the Minimum Requirements brings to waste disposal by landfill as against the third world outlook exhibited by the site in question. Waste management will be assessed in the Umlazi Landfill Site with this difference in mind. The control and operation of such a site is far beyond the scope of even sizeable local authorities.

The commonalities in the areas of non-compliance were the following: -

- Financial Constraints
- Technological Constraints
- Inadequate Implementation of Impact Management Systems
- Lack of Organisational Capacity
- Ineffective Monitoring Programmes
- Lack of Public Participation

Together with the issues of non-compliance, is the failure of timely action by national and provincial government departments to reinforce compliance and adherence to legislative requirements. This is largely attributed to the lack of staff due to staff turnover, lack of proper training and financial constraints.

Baseline studies done on landfill sites in South Africa and in the Kwazulu-Natal Province in particular give insight on the extent of the Permitting Process in terms of the Environment Conservation Act, Act 73 of 1989 and provide insight to the status of landfilling in South Africa. What is interesting to note, that although landfilling has

improved overall, areas of non-compliance with the Permit and with the Minimum Requirements by implication, are similar in most respects. This correlated to a large degree with the evaluation of the Umlazi Landfill Site.

- **Baseline Study on Waste Disposal Sites in South Africa**

In order to develop a national strategy for upgrading waste management in South Africa, more reliable information was required about the status quo. Although waste disposal is but one of four components of the integrated waste management, it is one that has the greatest impact on the environment. This study was conducted in an attempt to update the information that was currently available at the time as most of the information was based on estimation and was outdated.

The objective was to quantify the presently available landfills and the airspace (that is space available for landfilling), on a regional basis, in terms of total, hazardous and general waste landfill sites.

With regard to landfill permit status and compliance with the Minimum Requirements: -

- Regarding permit applications, it was noted that the Free State has applied for and granted the most permits. However, the provinces with the greatest percentage of landfills permitted were Gauteng, Free State and Kwazulu-Natal.
- Of the 329 permits applied for, 155 have been granted.
- Regarding the relationship between environmental acceptability and Permit status for all provinces, there was a decrease in percentage of non-complying landfills from the total to the permitted landfills. This indicates the permitting process has resulted in an improvement in landfill standards throughout.
- For the country as a whole, it was noted that 26 of the landfills were unacceptable, while of the permitted landfills this figure has dropped to 12. This indicates that the permitting process has definitely resulted in an improvement in landfill standards.
- The greatest improvements in compliance through the permitting process were noted in Mpumalanga Province, followed by Northern Cape.
- The provinces with the highest percentages of non-complying landfills in terms of both total and permitted landfills were Gauteng and Eastern Cape Provinces.

The study also revealed the miscellaneous issues that were evident from the response to the questionnaires from all the provinces. With regard to closed landfills complaints were received pertaining to illegal dumping and consequent odour, flies, unsightliness, where waste was not managed or covered properly. There were also reports of leachate production and ground and surface water pollution. There were reports of informal settlements adjacent to closed sites and squatters living on a site where landfill gas was evident. The theft of fencing and consequent problems of access control was reported. It was reported that several landfill sites classifies as general waste sites, receive hazardous and medical wastes. Reports of leachate production with no leachate containment or treatment measures were received. This was related to reports of water pollution in areas where ground and surface water are used for domestic purposes and irrigation. Burning of waste, and consequent air pollution was reported at many sites, as was the nuisance caused by windblown litter and odour.

- **Baseline Study on Waste Disposal Sites in the Kwazulu-Natal Province**

The baseline collection data exercise was aimed at all landfills, in the province, operated by Regional and Local authorities. According to this study there are 74 operating landfills recorded in the Kwazulu-Natal Province. These include 2 hazardous waste landfills and 72 general waste landfills. Of the total remaining hazardous airspace 100% is currently acceptable in terms of the Minimum Requirements. Of the total remaining general waste airspace, only about 38% is currently acceptable in terms of the Minimum Requirements. Based on the questionnaire returns, 18% of the landfills in Kwazulu-Natal province comply with the Department of Water Affairs and Forestry's Minimum Requirements, 64% potentially comply and 18% are unacceptable. Of the 46 Landfill Permits applied for, only 24 have been granted.

The study also revealed the miscellaneous issues that were evident from the response to the questionnaires for the Kwazulu-Natal Province. It was reported that several landfills that were classified as general waste sites, receive hazardous and medical waste. It was also reported that some general waste sites could be causing problems to residents, as waste is received and burnt 24 hours a day. Reports of leachate production, and possible

water pollution were noted at several landfills. Complaints of burning due to methane gas production have also been received. Several incinerators are in place for disposing of general wastes in small towns. It has not been determined whether or not these incinerators have the necessary permits. Previously Black Local Authorities also indicated that they needed assistance from the government in upgrading waste management in their areas.

#### **4.3.2 Identification of Constraints in Implementation of the Minimum Requirements at the Umlazi Landfill Site**

- **Financial Constraints**

- Lack of funds to implement effective treatment, drainage, gas and air quality systems, adequate liners and repair and purchase of equipment.
- Financial constraints imposed by external authorities.
- Non-payment for services.
- Inadequate cross-subsidy from industrial and commercial tariffs to domestic users in a once previous Black local authority.
- Complex and non-uniform tariff structures for services.
- Competition from other service departments within the local authority for funding.
- Lack of access to capital funding.

- **Technological Constraints**

- Over-reliance on imported equipment and technology.
- Substantial costs of purchase and repair of such equipment.
- Obsolescence of technology.
- Imported compactors often remain idle, as landfill operators do not have proper training or sufficient funds to operate the equipment.

- **Inadequate Implementation of Impact Management Systems**

- Gas Management System reliant on imported technology.
- No Leakage Detection System established.

- No need was ascertained for the implementation of an Air Quality Management System.
- **Lack of Organisational Capacity**
  - Lack of staff
  - Inadequate training in waste education.
  - Inadequate supervision of staff.
  - Management issues:
    1. Fragmented services lead to parochial planning and unequal service levels.
    2. Fragmented management arising from legitimacy of the existing structures and a general uncertainty regarding areas of responsibility.
    3. Low priority of waste management as an activity within local authorities.
    4. Staff and resources used for functional responsibilities outside solid waste.
    5. Absence of management in some cases and excessive spans of control in others. Lack of skills upgrading and development programmes with unclear career paths.
    6. Weak policing, low penalties and difficulty in obtaining court convictions. Inadequate
- **Ineffective Monitoring Programmes**
  - Gas wells, vents and probes were not functional that led to ineffective gas monitoring.
  - No air quality monitoring system was established.
  - Inadequate groundwater monitoring led to groundwater contamination.
  - Leachate monitoring was difficult due to topographical constraints. No leakage detection system was installed.
  - In-house audits were lax.
  - Lack of action from Departmental officials on independent audit findings perpetuated the lack of effective monitoring.

- **Lack of Public Participation**

- The Site was established prior to the advent of the Minimum Requirements.
- Promulgation of mandatory Public Participation occurred after the establishment of the Site.

#### 4.3.3 Identification of Broader Issues

- **Institutional inadequacies** are experienced at all levels, ranging from the policy-making down to the operation of the site.
- **Inadequate Income:** Local authorities tend to be under-funded largely due to inadequate recouping of rates from ratepayers. There is also a particular problem with squatter communities as people living in such situations are assumed to be less likely to pay rates and taxes hence argue that they cannot be served.
- **Economic factors:** Disposal charges depend on the site's cost of establishment and operation. Sites are significantly more expensive than in the past and tends to be further out of town to avoid densely settled areas. This increases the cost of waste management to the ratepayer or site user. Financial returns on peripheral activities such as scavenging, recovery of materials from the waste stream is minimal for this site in particular. High costs of operation of a site associated with increasingly onerous requirements by Regulators impact on the affordability of the site. For site users that have to make use of the disposal facilities, the risk of illegal dumping or illegal discharge of effluent increases because of the very high rates associated with transporting the waste to greater distances.
- **Social Impacts:** Poor planning and apartheid policies in the past resulted in problems regarding the siting and operation of waste disposal facilities in relation to residential and environmentally sensitive areas. Health and safety issues must be addressed for site staff in terms of the Occupational Health and Safety Act (Act 85 of 1993). A landfill is a hazardous place to work with the heavy machinery on site; the landfill gas and the potential health impacts from the waste itself. At many landfill sites scavengers congregate when there is inadequate access control. Informal communities establish themselves around these sites to eke out a living by salvaging recyclable materials from the site. (The then Minister of Water Affairs and Forestry disallowed

scavenging on site stating that he considers it beneath human dignity to engage in this activity). Quality of life issues relating to aesthetics are perceived by neighbouring communities as being very important: these would include issues such as odours, dust, wind scatter, noise, flies, vermin and dust. Traffic impacts along the access road through residential areas are also a factor as in this case.

- **Political:** Environmental and social justice issues relating to landfill site selection must be addressed in the light of past political dispensation. Many communities in South African cities have inherited poor land use planning outcomes from the apartheid era e.g. the location of Black living areas on the urban periphery, inadequate low grade housing and degraded, poorly maintained township infrastructure. These are examples of social injustice. In addition, industries, transport routes and infrastructural elements such as landfill sites, airports, power stations were located close to such communities, resulting in a range of negative environmental impacts on their quality of life. The decisions made because of political expediency are often not good from a waste management perspective. The premature closure of certain sections of the Umlazi Site due to political pressure can also have negative repercussions as no alternate site could be found.
- **Biophysical:** Leachate can affect ground and surface water quality if the proper controls are not established. Landfill gas is potentially explosive and hazardous if not managed correctly. Loss of habitat can result when a site is established in an area with high ecological carrying capacity. Degradation of an area may be a result of the development of a landfill site, depending on its previous ecological status.
- **Interrelated compound effects:** This is a combination of the abovementioned factors. An example of interrelated compound effects of inadequate waste management that exhibits political, biophysical, social and economic effects is that of the Umlazi Landfill Site.
- **Environmental considerations:** There is an absence of policy with respect to materials recovery and waste minimisation. There is an absence of an accessible and well-defined management and control system for dealing with toxic and hazardous waste. There is a need for a co-ordinated educational and promotional awareness programme to advise the public about the environmental issues surrounding waste

disposal at landfills. There is fragmentation of the responsibility for enforcement of by-laws at a local authority level regarding waste disposal. There is a lack of knowledge and awareness of the health impacts of poor waste disposal and the dangers of scavenging.

- **Over-reliance on imported technology:** Despite low-income bases and high cost of importing equipment and vehicles, importation is widespread. No effort is made to source cheaper technology and/or research into alternative technology. This places a strain on foreign exchange requirements because the initial capital outlay is followed up by replacement and maintenance costs. Import duties and taxes also contribute to the costs. The problem of obsolescence of technology is also another factor to be borne in mind.
- **Inappropriate methods of finance:** Waste compaction equipment has a relatively short life span, as vehicles usually last no more than five to seven years. Local authorities often tie themselves into loans over longer periods without considering the revenue raising capability of the vehicle and its time frame. The supplier company exacerbates this, in their attempts to make the terms of payment as attractive as possible to the purchasing party.

#### 4.3.4 Conclusion

Poor town planning and lack of provision for waste disposal facilities, inadequate allocation of resources for waste management both in the private and the public sector, lack of awareness of the full implications of poor waste management, lack of capacity particularly within government departments and general ignorance are significant factors when considering the some of the underlying causes of poor waste management. Waste disposal at landfill, being part of the waste management process was also subject to inferior standards. The advent of legislation and the Minimum Requirements sought to redress these problems and bring landfilling in South Africa to acceptable standards. However, being minimal as the name implies, it was shown that compliance depends on a number of resource requirements that is difficult to sustain over long term. There are a number of common constraints to developing and implementing effective waste management systems at disposal sites and these are summarised below: -



- Waste management is not a government priority compared to issues such as economic development, population growth, housing and employment.
- Awareness is lacking among generators of hazardous waste concerning the impact of their waste on the environment and the community.
- Inappropriate, incomplete, or diffuse waste management legislation and regulations.
- Inadequate enforcement of existing regulations and limited monitoring capability.
- Institutional arrangements among government departments and levels of government are poorly defined or non-existent.
- Technical or scientific capability and capacity of government agencies and institutions is limited.
- Data on current waste production and treatment and disposal practices are limited or scattered among a number of institutions and organisations.
- Existing disposal facilities are inappropriate or inadequate.
- The costs associated with developing and operating new facilities are prohibitive.
- Waste reuse, recycling and recovery programmes are operated on an ad-hoc basis, with limited or no controls.
- Lack of skilled human resources and equipment in industry and the private sector to deal with waste generation and management problems and to operate and maintain facilities.
- Existing industrial processes are inefficient, resulting in excessive waste generation and inordinate resource and energy consumption.
- Industrial development occurs in an uncontrolled manner.
- Companies that do not have the finances or the technical know-how to manage their wastes properly generate a significant portion of the country's industrial waste.
- Access to and affordability of appropriate technologies, processes and practices is limited.

The next chapter will highlight the conclusions and make recommendations to try and bridge the gap for effective implementation of the Minimum Requirements.

## **CHAPTER FIVE**

### **CONCLUSIONS AND RECOMMENDATIONS**

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#### **5.1 INTRODUCTION**

This chapter will summarise the conclusions of this study and make recommendations based on the conclusions reached. It is important to note that whilst a single case study was used as the basis for research, the findings and conclusions are similar to the baseline studies that were done for South Africa, on national scale and in Kwazulu-Natal on a provincial scale (as highlighted in Chapter Four).

#### **5.2 CONCLUSIONS**

The conclusion reached in the previous chapter show that the for effective implementation of the Minimum Requirements, the local authority is required to have adequate financial resources, technical resources, technological resources, human resources and buy-in to the concept of the graded standards in landfilling. The Minimum Requirements is, but, one in a plethora of laws governing waste management in South Africa. It is no wonder then that whilst it is an innovative and much-needed piece of legislation, for waste management practitioners it is often considered as too stringent, too prescriptive and with no cognisance taken of local conditions and existing practices. There were broader issues that were identified in the case study that could play an integral part in the implementation process.

We find the local authority combines the problems of developing first world conditions in the provision of waste disposal services in accordance with the Minimum Requirements whilst based in a developing third world situation. Landfill managers and decision-makers consider the overall design and operation of a disposal site a low priority. Whilst South Africa has successfully bridged the gap of the first and third world divide in some areas, it falls behind in certain areas in stark comparison. Waste management and disposal in particular. In South Africa a total of some 540 millions tonnes of waste is produced annually, by a population of just over forty million people. Historically 98% of this is disposed of on land. There is a general lack of awareness in South Africa on waste

issues and a history of inadequate resources being allocated to improving the standards of waste management. Throughout there is growing concern about the rising levels of pollution and waste, which are having a detrimental effect on health and the natural environment. Globally increased urbanisation and industrial development are causing waste and pollution levels to rise. In South Africa the situation is exacerbated by the apartheid legacy that resulted in disempowered communities and local authorities bearing the brunt of the pollution burden. Good waste management therefore has been the exception rather than the rule. Poorly managed waste has the potential to impact on virtually every other facet of the broader environment, going beyond even impacts on the physical media i.e. air, water, and soil where it is the most likely cause of pollution. Rapid population growth, urbanisation and industrialisation, together with under-resourced waste removal and disposal services, have resulted in environmental degradation and health risks in the disadvantaged communities. In the past, poor siting and operation of waste disposal sites has meant that people living in the vicinity of the sites have had to endure the obvious impacts such as odour, dust, noise, negative visual effects and traffic impacts. The less obvious impacts are more insidious but have much more severe consequences with longer term implications if left uncontrolled: ground and surface water pollution by leachate, and hazards associated with the mixture of methane and carbon dioxide gases generated at landfill sites.

The new dispensation in South Africa has led to enormous changes in the legal framework of the country, and these new laws have brought far-reaching implications, especially for local authorities. Sustainable waste management and the hierarchy of prevent, reduce, reuse, recycle, and dispose means something entirely different to a cash-strapped, under-resourced local authority, than to a large corporation striving for ISO14001 certification and international trade relationships. Local authorities have a constitutional responsibility, both as a service provider and a regulator to deal with all types of waste generated in their areas of jurisdiction. These responsibilities entail that changes in legislation be rigorously observed by local authorities and implemented accordingly. In terms of sections 83 and 84 of the Local Government Municipal Structures Act, Act 33 of 2000, a local authority must ensure integrated, sustainable and

equitable social and economic development through providing services and regulating inter alia: -

- *waste disposal sites in so far as it relates to the determination of a waste disposal strategy, regulation of waste disposal and establishment, operation and control of waste disposal sites, bulk waste transfer facilities and waste disposal facilities.*

The Act indicates the differentiation between the regulatory responsibility of a local authority as a regulating authority and its function as a service provider that is being regulated by national and provincial government. Local government must assume duty for these matters by taking proficient decisions on service delivery and by regulating relevant aspects through by-laws to ensure that both its service provision and regulation functions are appropriate, affordable and in compliance with national legislation.

Should a waste management audit be carried out on the average South African local authority to determine compliance with national legislation with both its regulated functions and regulatory responsibilities, typical audit findings would include the following: -

- Waste treatment and disposal are ineffective to treat or dispose of the waste streams generated in the area of jurisdiction;
- Operation of these facilities for waste treatment and disposal are poor; incorrect disposal methods and techniques are used;
- Disorganised waste reclamation when allowed, is a characteristic feature of many waste disposal sites, which not only has a negative impact on operation, but also places the lives of both operators and reclaimers at risk;
- Selection of suitable sites, treatment technologies and environmental media for disposal are inapt due to affordability, technological and human resource constraints.
- Potential pollution risks are posed by waste treatment and disposal facilities due to the lack of capacity and mechanisms to identify these situations and inadequate risk reduction measures such as designs, storm-water control systems, buffer zones etc., to prevent pollution; and
- Some of the waste disposal facilities are operated illegally because they are either not permitted in terms of the Environment Conservation Act, Act 73 of 1989, or if they are permitted, the permit conditions are not complied with.

On a national and provincial level, the main problems associated with the disposal of waste that have been identified are: -

- National government (Department of Environmental Affairs and Tourism and Department of Water Affairs and Forestry) has insufficient financial and personnel resources to effectively administer and enforce the waste management legislation. This situation has resulted in illegal dumping and an apparent reluctance on the part of some disposal site owners to comply with the current waste disposal standards.
- Knowledge and experience in the field of waste treatment and disposal lies predominantly within National government. As Department of Water Affairs and Forestry is understaffed and is obligated, in terms of the National Water Act, Act 36 of 1998, to implement water quality-related source control, it will not be able to second staff to Department of Environmental Affairs and Tourism for the implementation of the NWMS.
- Limited technical and environmental expertise at the local and provincial level of government will impact on the effective planning, development and establishment of waste disposal facilities.
- Due to a lack of resources provincial governments have not accepted the responsibility of managing the hazardous waste stream (treatment facilities/disposal sites).
- Many disposal or treatment facilities, including medical waste, are not properly managed, and will be unable to comply with the expected standards. They are also often poorly located and create unacceptable environmental conditions for adjacent communities.
- The legislative control and enforcement of existing standards within the waste treatment field is inadequate, for example Department of Environmental Affairs and Tourism have only six air pollution control officers operating throughout the country.
- The current definition of medical waste is inadequate and will be revised.

- There are many waste disposal sites, which are still impacting on the physical and social environments, due to poor planning in the past. A lack of enforcement and resources is delaying the remediation of these sites.
- Due to poor controls and standards, medical waste, hazardous waste and sewage sludge are being illegally dumped or disposed of at sub-standard waste disposal sites, often without appropriate pre-treatment. These practices result in increased health risks.
- Informal salvaging at the working face of landfills is widespread in South Africa. This practice is problematic, as salvagers are exposed to health and safety risks, and proper operation of the landfill is disrupted.
- There is widespread public opposition towards the incineration of wastes, as well as the location of many waste disposal and treatment facilities.
- The cost of modern treatment technologies and environmentally acceptable disposal of waste is high in comparison to those costs incurred for the management of waste in the 1980's. The waste generator is not used to high disposal costs, and often does not understand why high costs/tariffs are necessary. This negative perception can be addressed with well-designed environmental education and public awareness programmes.
- The Minimum Requirements for such waste disposal facilities are inappropriate, and unrealistically conservative in some respects and appropriate and practicable Minimum Requirements must be developed for such facilities.

The response to the Minimum Requirements tended to vary in accordance with the viewpoints of the various stakeholders that were interviewed. The Local Authority felt that standards were too high and impractical while National and Provincial Government felt they were not sufficiently stringent to protect the environment and public health. The Minimum Requirements instituted in South Africa offer only limited guidance on landfill gas management. There were also those who appeared to oppose both the Minimum Requirements and its implementation on principle, in all tiers of government. Some had problems with the public participation process associated with the development and implementation of the Minimum Requirements per se. Another area of concern was that

the document does not deal sufficiently with the first three components of Integrated Waste Management, i.e. waste minimisation, recycling and treatment. Although the Department of Water Affairs and Forestry fully subscribes to all four components of Integrated Waste Management, the Minimum Requirements specifically deals with waste disposal at landfills.

### 5.3 RECOMMENDATIONS

The conclusion reached in this study of the effective implementation of the Minimum Requirements at a waste disposal facility in order to maintain waste disposal standards led to the formulation of the following recommendations: -

- South Africa does not have an all-embracing National Act dealing with waste. The CSIR identified 37 key national statutes and 16 provincial ordinances that cover land-based waste and pollution control law. The statutes identified by the CSIR justify Myburgh's statement that there are a 'plethora of laws which seek to regulate waste management.' (Myburgh: 1991). Myburgh also expresses the opinion that the law is 'in a mess', because there are so many laws and they often fail to address the issues raised by the activities, which they seek to regulate. Lombard et al point out that the penalties which are provided in the legislation for transgressions are often not appropriate or stringent enough, they are not uniformly applied, and interest among and support from justice officials in the enforcement of the provisions of the legislation is poor. The plethora of laws inevitable means that there is an abundance of central government departments with some involvement in the regulation of waste management. Apart from the limited capabilities of departments directly involved in regulating waste management, the multiple overlaps in jurisdiction coupled with the absence of a hierarchy of authority, means that no Department or individual is in charge, which in then has the result that no one is accountable.

Therefore it is suggested that: -

- Legislation should be holistic in approach.
- A single comprehensive waste management Act should be passed.
- Such an Act would supplement and co-ordinate all relevant legislation.

- Legislation should be comprehensive in that it deals with all facets of waste; generation, avoidance, re-use, recycling, collection and disposal.
  - Legislation should confer powers on provincial and local authorities to regulate aspects that require a particular provincial or local approach.
  - Provide for the waste education of the provincial and local tiers of government and the public in general regarding the environmental impact issues affected by the management of waste from generation to disposal.
  - Areas of jurisdiction on national, provincial and local government level is clearly spelled out.
- The rule rather than the exception should decide a Minimum Requirement. The principles involved in the Minimum Requirements cannot address every situation nor can it adopt a ‘one size fits all’ approach. Where exceptions exist, these must be identified and addressed in consultation with the Department of Water Affairs and Forestry. Minimum Requirements tend to concentrate on objectives and principles, rather than on detail. This means that, although explanatory detail is sometimes provided, Minimum Requirements generally specify the expected standard, rather than the method of achieving it. Numerical requirements should have been used with discretion. The reason for this is that each situation must be considered on its merits. The inclusion of too many numerical requirements transforms the document into a prescriptive handbook. Experience has shown that numerical requirements can be misunderstood, misapplied and/or abused. The degree to which a Minimum Requirement is applicable is not specified. The degree to which a Minimum Requirement must be executed, in order for the end result to be acceptable to the Department, is not specified. This must be determined by site- specific circumstances. Practicality should dictate, to take cognisance of local conditions. The Minimum Requirements are frequently less stringent in developed countries. This is to ensure practicability and sustainability under local conditions. At no time, however, will the protection of the environment be compromised. An example of a ‘less than ideal’ requirement would be the number of exploratory boreholes at a given site. Although the ideal would be to drill sufficient boreholes to provide a full understanding of the



site for the purposes of design, this is not always possible. Flexibility of Standards should therefore be considered. Minimum Requirements are intended to raise the standard of waste disposal in South Africa to an environmentally acceptable level, on a national basis. They therefore provide uniform procedures, specifications and standards for waste management, to which all parties can work. However, since site-specific conditions may vary, provision must be made for defensible flexibility. The Minimum Requirements therefore should be seen as a reference framework of minimum standards to be adhered to (the rule) or deviated from (the exception). Where site-specific factors are such that the rule is not appropriate, provision should be made for defensible deviation from the Minimum Requirements. Deviation from the rule may involve either an increase in standards or a relaxation. It is a Minimum Requirement, however, that any deviation be properly researched, motivated and recorded, so that it is indeed defensible, and that the environment is not threatened.

- Buy-in to the concept of Minimum Requirements should be encouraged. Local authorities should view it as a positive step in the right direction. The Minimum Requirements should be regarded as beacons on our route to better waste management. In the absence of waste disposal standards in this country in the past large volumes of waste were simply dumped. Waste disposal, therefore, had an adverse impact on the environment and public health, particularly in cases where there has been no thorough waste management planning, the landfill has been inappropriately sited and designed and inadequately managed and operated. The main effect of the Minimum Requirements is the improvement of the quality of landfilling throughout the country, due to upgrading and higher environmental standards for

landfill sites. In order to strive for quality, there will be a concomitant increase in the cost of disposal, but in the long term the investment should pay off. Like a company that strives for ISO14001 certification, the Department of Water Affairs and Forestry could issue a local authority a certificate of compliance with the Minimum Requirement status. This could indeed boost the public relations image of the local authority in its area of jurisdiction. Another factor is large industrial companies being waste generators will need to ensure that their wastes are dumped at a permitted landfill site and a site that is complying will indeed encourage them to make use of the waste disposal facility. This could result in a larger revenue base for the local authority. The local authority must also allocate adequate funds and resources in their budget, to waste management. Too often it has been sidelined in favour of what is construed as more important initiatives like housing and economic development.

- In order to augment funds that a local authority may require to comply with the Minimum Requirements, the National government department could provide funds for sites that need upgrading to ensure compliance, especially those established in the pre-standards era. The World Bank and other international aid and donor countries are in favour of good landfill practices that ensure the protection of the environment and the public. There could be channels to source funds to aid in the upgrade and maintenance of landfills. South Africa, being classified as a developing country will qualify.
- Municipal solid waste management is an essential public service that benefits all residents. It is not feasible to exclude from service those who do not pay, because public cleanliness and the safe disposal of wastes are essential to public health and environmental protection. As a result of these characteristics, solid waste management is a public good for which local or metropolitan governments are typically responsible. This does not, however, mean that local government has to accomplish the task of solid waste service delivery entirely with its own staff, equipment, and monies. In fact, this is where the role of the private sector comes into

play. The reduction of government activity through the participation of the private sector in service delivery should be considered. Private sector participation is a possible opportunity-not a panacea. In situations in which existing service delivery is either too costly or inadequate, private sector participation should be examined as a means of enhancing efficiency (and thus lowering costs) and mobilizing private investment (and thus expanding the resources available for urban infrastructure and equipment). Solid waste management is a public good. Solid waste management is a service for which local government is responsible. This service is nonexclusive, meaning that once it is provided to some portion of a community it benefits the overall public welfare, not only the resident that specifically receives service (the service is also non-rivalled, meaning that any resident can enjoy the benefit of the service without diminishing the benefit to anyone else. Beyond this, it is not feasible to exclude from service those who do not pay, because public cleanliness and the safe disposal of waste are essential to public health and environmental protection. These qualities of being nonexclusive, non-rivalled, and essential place responsibility for solid waste management squarely within the public domain as a public good. Because of this issue, the level of government responsible is typically local or metropolitan government. This does not, however, mean that local government has to accomplish the task of solid waste service delivery entirely with its own staff, equipment, and monies. In fact, this is where the role of the private sector comes into play. What is privatisation? Generally stated, privatisation is a reduction in government activity or ownership within a given service or industry, as follows: Government activity is reduced when the private sector participates in service delivery. Government ownership is reduced when a) government enterprises are divested to unregulated private ownership and b) government agencies are commercialised (reorganized into accountable and financially autonomous semiprivate enterprises).

- The local authority could consider the option to outsource activities like waste treatment and disposal. This could be seen as a public, private partnership. Partnership between government departments and private sector is an ongoing process in South Africa. A number of government departments across all tiers of

government have embraced the concept of private sector involvement. The government's privatisation strategy and restructuring programmes make way room for outsourcing. This viewed as a method for using private skills and funds. The outsourcing has been shown to be largely manageable, commercially viable and successful in most partnerships between the government and private sector. Local authorities are experiencing more and more difficulties in delivering adequate waste disposal services to their constituents. In order to address this problem, the Government of South Africa investigated the involvement of the private sector in municipal service delivery. Municipal services are normally considered to be engineering services such as water supply and sanitation. However this includes waste collection and disposal. Over the past years, the Government has at numerous occasions stated that local authorities should investigate conditions to outsource municipal service delivery to focussed companies concentrating on a specific service. By doing this, the local authority can concentrate on their core functions. The main advantages to involving the private sector are: -

- To achieve a higher level of service.
  - To leverage additional capacity and investments.
  - To deliver a better quality of service.
  - To deliver a more cost-effective service.
- Appropriate awareness and competency training programmes in the waste management field have not been developed or implemented anywhere in South Africa. On-the-job training is more common practice. The local authorities do not have in-house waste management training who rely on a 'sit-by-nellie', on-the-job, ad hoc type training, with no attention being paid to the overall outcomes or a broader environmental perspective. The Minimum Requirements provides a step in the right direction, however much more in the way of competency and awareness training is needed to ensure the safe handling, storage and disposal of the various types of benign, toxic and hazardous wastes found in this country. A waste management training programme focused on the councillors and officials of local authorities as well communities should be designed, developed and implemented as a

priority by the central government authorities. Such a training programme should cater for all people at all different levels of education. Without a concerted awareness-creation programme very little will be achieved through more legislation, more law enforcement and more expenditure on waste management systems. Because it is a requirement in terms of the Occupational Health and Safety Act, Act 85 of 1993; the information and training must be provided by an employer to ensure the health and safety at work of employees. This compliance would apply in general sense to landfill site staff as well.

- The operation of a sanitary landfill should be the long-term aim of a responsible local authority. The first question that needs to be addressed by a local authority is whether it has the technical resources to do so. A useful range of professional skills that is recommended include: -
  - Waste management
  - Civil engineering
  - Hydrogeology
  - Geo-technical engineering; and
  - Hydrology.

The local authority should see whether it has these skills within its organisation; whether they need to be sourced from other organisations or whether part or whole of the operation will have to be carried out outside agencies; for example institutes, consultants or waste management contractors. It should also be recognised that to run successfully better-managed landfill, changes may be needed in the local authority. A better-managed landfill needs operational decisions to be made quickly by personnel regularly working on site. Good landfill management cannot be achieved if there is a large burden of bureaucracy inhibiting operations. A frank judgement has to be made before operating a site on whether the public sector is the best organised to run a better operated landfill. A careful consideration of the potential advantages and disadvantages of using the private sector should be made. Contracting out the landfill operations and local authority staff to oversee the contractor is performing to the

required standard of operation may be a good solution. The local authority would still retain the responsibility for, and control of waste management.

- Landfill technology should try as far as possible to be sourced from local suppliers. For landfill technology used to be sustainable in the long-term, the level must be commensurate with the local ability to maintain, repair and extend in the long terms. Where this ability does not exist or cannot be developed through training, high-tech systems and equipment should be avoided. Local resources should be utilised wherever possible, in the interests of promoting both sustainability and affordability. While it is easier to deposit waste carefully in a landfill site using a bulldozer or similar mechanical equipment, it is not necessarily essential. Manual operation i.e. without the use of mechanical earthmoving equipment can be effective if no machines are available and there is plentiful supply of manual labour. However, this should not be encouraged at a hazardous landfill site.
- The permitting of scavenging should be considered. By its nature scavenging is disruptive to good landfill operations. Ideally, it should not be allowed to take place. However, in many places it is inevitable. Scavenging is ubiquitous in a country like ours, where poverty is rife. If scavenging is to be allowed it should be controlled. The main objections to scavenging are the safety hazards to both scavengers and landfill employees; the interference caused by scavenging on the efficient conduct of work on site; a reduction in productivity of the equipment through delays in waste compaction and the application of soil cover; and the setting of fires. To tolerate the presence of scavengers requires decisions on how best to enable them to sort through the waste without interfering with the subsequent placement and covering of waste in the landfill. To prevent any dangers to scavengers themselves regarding the health hazards, the danger of methane gas explosions, and contact with hazardous waste amongst others as well as the disruption of operations on site, permitting of scavenging must be re-looked at.

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- Public Participation (PP) is a legal pre-requisite for the siting and operation of landfill sites. Public participation in a siting of a landfill site is compulsory. A single meeting of ‘interested and affected parties’ advertised in small print in local newspapers does not constitute Public Participation. This is especially so when many of the local residents are illiterate. A partnership must be forged between the public, contractors (if applicable) and the government. A climate of credibility must be created so that if a site is granted a permit by the Department of Water Affairs and Forestry, the public knows its interests and concerns have been looked after and the site poses no threat to health or environment. However, Public Participation is often misunderstood. This is validated by community complaints being ignored, antagonistic community relations, unpopular policies and political apathy. Public Participation is generally misunderstood not so much by the Public but by the PP practitioners themselves. The lack of understanding revolves around essentially three factors: -
  - Lack of knowledge around South Africa’s legal framework
  - Lack of political understanding
  - Lack of skills in Public Participation.

Therefore the following guidelines are recommended: -

- The Interested and Affected Persons (IAPs) must be consulted and given opportunities to participate in the landfill operation.  
The spirit, public opinion and the will of the people must be recognised. Local people must therefore be involved and encouraged to take ownership of it. They must be given the opportunity to participate in the planning and execution of those areas that could have an adverse impact on them.
- The IAPs must be given the opportunity to be involved at all stages of landfilling as far as possible.  
Adequate notification must be given to the IAPs. In particular the IAPs must be allowed to reasonably define the extent to which they wish to be included and thus to define the formal participation process they wish to see followed. They must not be confronted with an accomplished fact.

- The IAPs must be informed and empowered, so that they can contribute effectively any major decisions regarding the landfill that could impact on them.  
Giving IAPs access to the relevant information can do this, whether through meetings, presentations, discussions or reports and documents.
- The information on which decisions are taken must be sufficient.  
This means that it must be understandable, so that the IAPs can contribute effectively.
- There must be consideration of alternative options.  
Any major development proposal must provide for 'the due consideration of alternatives'. It must therefore contain alternative options for reaching the same goal, including the option of no development. The IAPs must also be allowed to add more options. The information supplied in support of the different options should be sufficient to enable valid evaluation.
- The adjudication process must be fair and just.  
Adjudication must be public and informal, but orderly. Reasons for decisions should always be given and must be sufficient to illustrate that the input of all parties was taken into account and given appropriate weight.
- Mechanisms for Identifying IAPs  
Different decisions will have to be made at the various stages of the landfill process. The objective is to identify those IAPs who might reasonably wish to become involved in making that specific decision. IAPs would include the democratically elected representatives of the people, government departments, provincial government departments, local authorities, waste generators, residents in the nearby vicinity, water users, local water authority, local communities, Non-Government Organisations (NGOs), Community Based Organisations (CBOs), the Institute for Waste Management and others. In landfills that have already been developed, informal salvagers would be considered to be IAPs. The identification of an unreasonably wide range of IAPs, or the wrong IAPs, will waste time and money. It is therefore important to identify legitimate community representatives. Those IAPs who might be affected materially or who might have a legitimate interest in a decision should be identified. It will not always be necessary to involve people who are only marginally affected by or who have only a tenuous interest in a decision.



- Alternative methods of waste disposal could be considered. There are alternatives like incineration and composting. This could reduce the amount of airspace (or land) needed for sanitary landfilling, reduce the negative impacts on the environment and be more cost-effective. However, each could pose other negative environmental impacts that are unique to that particular method as well as may not be possible for certain types of wastes that are produced.
  - Government should concentrate on the first three steps of the waste hierarchy, i.e., Waste Avoidance, Waste Recycling and Waste Treatment. In the past local authorities have focused almost exclusively on waste disposal. Emphasis should now be placed on waste reduction. The Integrated Pollution and Waste Management Policy is a step in the right direction. Cleaner Production aims to avoid the production of wastes, recycling and reuse brings forth the concept of sustainability and income generation. Waste treatment seeks to minimise the negative impacts on the environment and public health. Some wastes will have to be disposed. This is inevitable and unavoidable as not all wastes can be avoided, reused, recycled or effectively treated. However, if this is indeed the case, then it should be safely disposed off. The author thus recommends that research and development should focus on the first three steps in the waste hierarchy.
- .
- Due to the limitations, as highlighted in Chapter One, it is recommended that landfill sites be looked at across the Kwazulu-Natal Province, and indeed South Africa as a whole, to obtain a holistic perspective of capacity/incapacity at local government level. The landfill sites selected should be of both general and hazardous types. This could depict common and unique resource requirements that are necessary for the effective implementation of the Minimum Requirements. All tiers of government should view the research as a means of improving co-operative governance in the waste management field in particular but most importantly ensure that landfilling is done in a manner that is not detrimental to the environmental and social well being.

#### 5.4 SUMMARY

South Africa's growing population and economy are resulting in increasing levels of waste production. The majority of this is currently disposed of in landfill sites, but existing disposal capacity is limited. Poor disposal of waste is having significant negative impacts on the natural environment and potentially on community health. The growth in the population and economy has resulted in increasing levels of waste production throughout the country. Poor disposal of waste at landfills has had significant negative impacts on many aspects of the natural environment as well as negatively impacting on the health of some communities. Together with this was the lack of Public Participation and community involvement, which in the pre-standards era was not mandatory. Politics in also played a role in the siting and operation of landfills. Waste was indiscriminately dumped with no cognisance of the communities that dwelt near the perimeters of the site. Government recognised the need to promulgate legislation to regulate the waste disposal practices. The overall objective of the Minimum Requirements was to upgrade the standard of landfilling in South Africa. Higher standards, however, invariably involved higher costs and a greater need to for training and skills development for landfill operators. On the one side, the local authorities that have to deal with the increased costs consider the standards too high, whereas national and provincial government feel that the environment and the people were at risk consider the standards adequate. This study looked at a landfill in the Kwazulu-Natal Province in order to highlight the areas of incapacity and drew conclusions and made recommendations to aid in the effective implementation of the Minimum Requirements.

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