

**A WASTE MANAGEMENT AND SANITATION AUDIT OF THE SOUTH
AFRICAN NATIONAL DEFENCE FORCE IN RURAL DEPLOYMENTS IN
MAPUTOLAND: A CASE STUDY**

By

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PREFACE

The research work described in this dissertation was carried out in the School of Life and Environmental Sciences, University of KwaZulu-Natal, Durban on a part time basis from July 2003 to August 2004, under the supervision of Dr Helen Watson.

The study represents original work by the author and has not been submitted in any form to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.



Ms R.Varaden

The work presented in this dissertation has been verified by the following supervisor and is in accordance with the criteria for submission for the Degree of Masters of Science

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ABSTRACT

Stringent national legislation on the disposal of waste and waste disposal sites has been promulgated to regulate the dumping of unwanted materials. This development poses major legal compliance problems for the South African National Defence Force (S.A.N.D.F.) deployments in rural areas. The absence of municipal services to these areas and the unavailability of municipal dumpsites do not facilitate adherence to legislation. The development of an integrated waste management system for Defence represents an attempt to ensure compliance with national legislation. An overview and assessment of current waste management practices in the S.A.N.D.F. is provided in this document.

The literature review focussed on the theory of waste management, the current situation with regard to sanitation in rural areas and a review of pertinent legislation, and provided the foundation for the development of questionnaires. The study then explored aspects of waste management and sanitation that were taken into consideration in preparing for operations. Data collection entailed interviews with senior members of the S.A.N.D.F. who are responsible for the planning of such projects. Thereafter an investigation was conducted into the waste management practices employed during deployments to rural areas. Data collection in this respect involved the administration of questionnaires to soldiers at temporary bases and during patrols, as well as an audit of the waste generated at the temporary bases, noting how refuse was managed under these conditions. These methods of primary data collection included interviews with various government and non-government officials.

Interviews with senior members of the S.A.N.D.F. revealed that the planning and preparation for operations are core-function focused and that the integration of waste management and sanitation in the planning process is minimal and inadequate. The data obtained from questionnaires administered to the soldiers revealed that current waste management practices at the temporary bases and during patrols are considered to be satisfactory to the soldiers, as they are of the opinion that "we are doing the best we can under such circumstances". The waste audit revealed that ninety-eight percent of the waste generated in the study area is recyclable. Consequently, this study recommends that waste management methods be integrated into the planning process. Furthermore it is recommended that environmental

education be included as a compulsory module during basic training and re-training for all members of the S.A.N.D.F., i.e. from senior management down to the most junior level.

A long-term solution to improve on the current waste management practices is recycling. With regard to sanitation, the Director of Sanitation of the Department of Water Affairs and Forestry (D.W.A.F.) suggested that relevant members of the S.A.N.D.F. meet with members of D.W.A.F. and the Umkhanyakude Regional District Council, to discuss the inclusion of the S.A.N.D.F. in the current sanitation-provision projects in the study area.

Short-term solutions were that the S.A.N.D.F. liaise with the G.I.S. section at D.W.A.F. This section will be able to provide the S.A.N.D.F. with information on the location of boreholes and hand-pumps (the only source of drinking water for the local population). The S.A.N.D.F. must ensure that waste disposal sites and field toilets, commonly referred to as go-karts, are located away from these water sources and, whenever possible, on higher ground.

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LIST OF ABBREVIATIONS

A.F.M.D.W.	Airforce Mobile Deployment Wing
B.L.C.	Borderline Control
Capt	Captain
C.O.N.N.E.P.	Consultative National Environmental Process
C.M.A.	Catchment Management Agencies
C.S.A.N.D.F.	Chief of the South African National Defence Force
C.S.I.R.	Council for Scientific Industrial Research
C.W.S.U.	Community Water Supply Unit
D.A.E.A.	Department of Agriculture and Environmental Affairs
D.E.A.T.	Department of Environmental Affairs and Tourism
D.o.D.	Department of Defence
D.W.A.F.	Department of Water Affairs and Forestry
E.C.A.	Environmental Conservation Act No 73 of 1989
E.H.O.	Environmental Health Officer
E.I.P.	Environmental Implementation Plans
E.M.P.	Environmental Management Plans
E.R.F.	Environmental Review Forum
G.I.S.	Geographical Information Systems
G.S.B.	General Support Base
G.S.M.	Group Sergeant Major
H.Q.	Headquarters
I.D.T.	Independent Development Trust
i.e.	Id est (that is)
I.P.W.M.	The White Paper on Integrated Pollution and Waste Management

K.Z.N.	KwaZulu-Natal
L.O.C.	Liaison Operational Committee
Lt. Col.	Lieutenant Colonel
M.L.O.	Medical Liaison Officer
N.E.M.A.	National Environmental Management Act No 107 of 1998
N.W.A.	National Water Act No 36 of 1998
N.W.S.	National Waste Management Strategy of 1999
Ops.	Operations
O.H.	Operational Headquarters
R.C.R.A.	Resource Conservation and Recovery Act
R.S.A.	Republic of South Africa
S.A.B.S.	South African Bureau of Standards
S.A.N.D.F.	South African National Defence Force
S.A.S.A.	South African Sugar Association
S.E.Wing. Group	Strategic Environmental Working Group
SO1	Staff Officer Grade One
SO2	Staff Officer Grade Two
T.B.	Temporary Base
U.M.D.	Umhlabyalingana Municipal District
U.S.A.	United States of America
V.I.P.	Ventilated Improved pit
W.O 1	Warrant Officer First Class
w.r.t.	with regard to
W.S.A.	Water Services Act No 108 of 1997

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CHAPTER 1

INTRODUCTION

“Coping with environmental management across the scope of military activities we know today could assume the form of a multitude of isolated endeavours faced independently by different force structure elements in frantic reaction to any spectrum of prevailing environmental issues. Defence could on the other hand, follow the proven path of an integrated and systematic approach that anticipates management intervention and strives towards continual improvement in the environmental management performance of the organisation as a whole” (Van Blerk, 2001:1).

1.1 Motivation for Study

Stringent national legislation on the disposal of waste and waste disposal sites has been promulgated to regulate how refuse is managed. Legislative provisions in this matter includes the Environmental Conservation Act No 73 of 1989 (E.C.A.)(R.S.A., 1989), the National Water Act No 36 of 1998 (N.W.A.)(R.S.A., 1998), the Hazardous Substances Act No 15 of 1973 (R.S.A., 1973), regulations in terms of the Pollution Prevention Control Act No 45 of 1965 (R.S.A., 1965) and the National Environmental Management Act No 107 of 1998 (N.E.M.A.)(RSA, 1998).

It is difficult for the S.A.N.D.F. to comply with national waste management legislation during rural deployments, as these areas are characterised by the lack of the provision of municipal services and municipal landfill sites. In order to ensure compliance with national legislation, a comprehensive policy on integrated waste management needs to be compiled and implemented. However, before such a document can be developed, it will be necessary to assess the current situation with regard to waste disposal in the S.A.N.D.F. (Liebenberg, 2001). This research determines the extent of legal compliance levels of waste management in the S.A.N.D.F. and makes recommendations for the improvement of current waste management and sanitation practices, which will bring the S.A.N.D.F. in line with national legislation. The data obtained in this dissertation will be incorporated into the formulation of an Integrated Waste Management System for the S.A.N.D.F.

1.2 An Environmental Implementation Plan for the S.A.N.D.F.

The N.E.M.A. (R.S.A., 1998) issues instructions to scheduled organs of state to develop Environmental Implementation Plans (E.I.P.) and Environmental Management Plans (E.M.P.). The purpose of the E.M.P. is to co-ordinate and harmonise environmental policies, plans, programmes and decisions of the various national departments and provincial and local spheres of government, that exercise functions that affect the environment or that are entrusted with powers aimed at the achievement and promotion of sustainable environment. The S.A.N.D.F. is amongst these scheduled national departments and, in order to comply with the stipulations of the N.E.M.A. policy, prepared an E.I.P. to meet the 31 August 2000 deadline (E.I.P., 2001). The E.I.P. was compiled by the Strategic Environmental Working Group (S.E.Wing Group).

1.3 An Environmental Management System for the S.A.N.D.F.

The S.E.Wing Group was instrumental in setting up the Environmental Review Forum (E.R.F.), whose task is the establishment of an ISO 14000 series for S.A.N.D.F. The E.R.F. conducted a review of all environmental legislation applicable to S.A.N.D.F. in order to determine the fundamental requirements for environmental compliance. Their investigation incorporated 35 National Acts and 72 scheduled processes that have environmental implications for the S.A.N.D.F. (Van Blerk, 2001). One of the seven most significant environmental issues identified by the E.R.F. after this review process was waste management.

1.4 Motivation for Study Area

This research focused on solid waste management in the rural deployment areas. The probability of there being waste management problems in such areas is high, due the nature of such deployments and lack of municipal services. The temporary bases situated at Kwa Mashudu and Farezella, within the Umhlabuyalingana Municipal District (U.M.D.), will be the focal points of this research. Deployments in these areas are all year round and the waste generated from these deployments is managed by means of digging, burning and burying. The sewerage is disposed of directly into the ground.

1.5 Aim

To determine whether the waste management and sanitation practices currently used by S.A.N.D.F. deployments at the specific sites in the Umhlabuyalingana Municipal District comply with legislative requirements.

1.6 Objectives

- To identify the types of waste generated.
- To estimate the quantities of waste generated.
- To establish how waste is currently disposed of.
- To establish if waste management planning is integrated into the operational planning of the S.A.N.D.F.
- To establish whether the soldiers are educated about waste management.
- To determine the national and the provincial legal requirements for waste management in the research area.
- To assess the effectiveness of current S.A.N.D.F. policies dealing with waste management.
- If necessary, to recommend how the current waste management practices in the research area can be improved.

1.7 Research area

1.7.1 Location

Farezella is located at 26° 54' 03" south latitude and 32° 43' 34" east longitude and Kwa Mashudu at 26°31'55" south latitude and 32°49'46" east longitude.

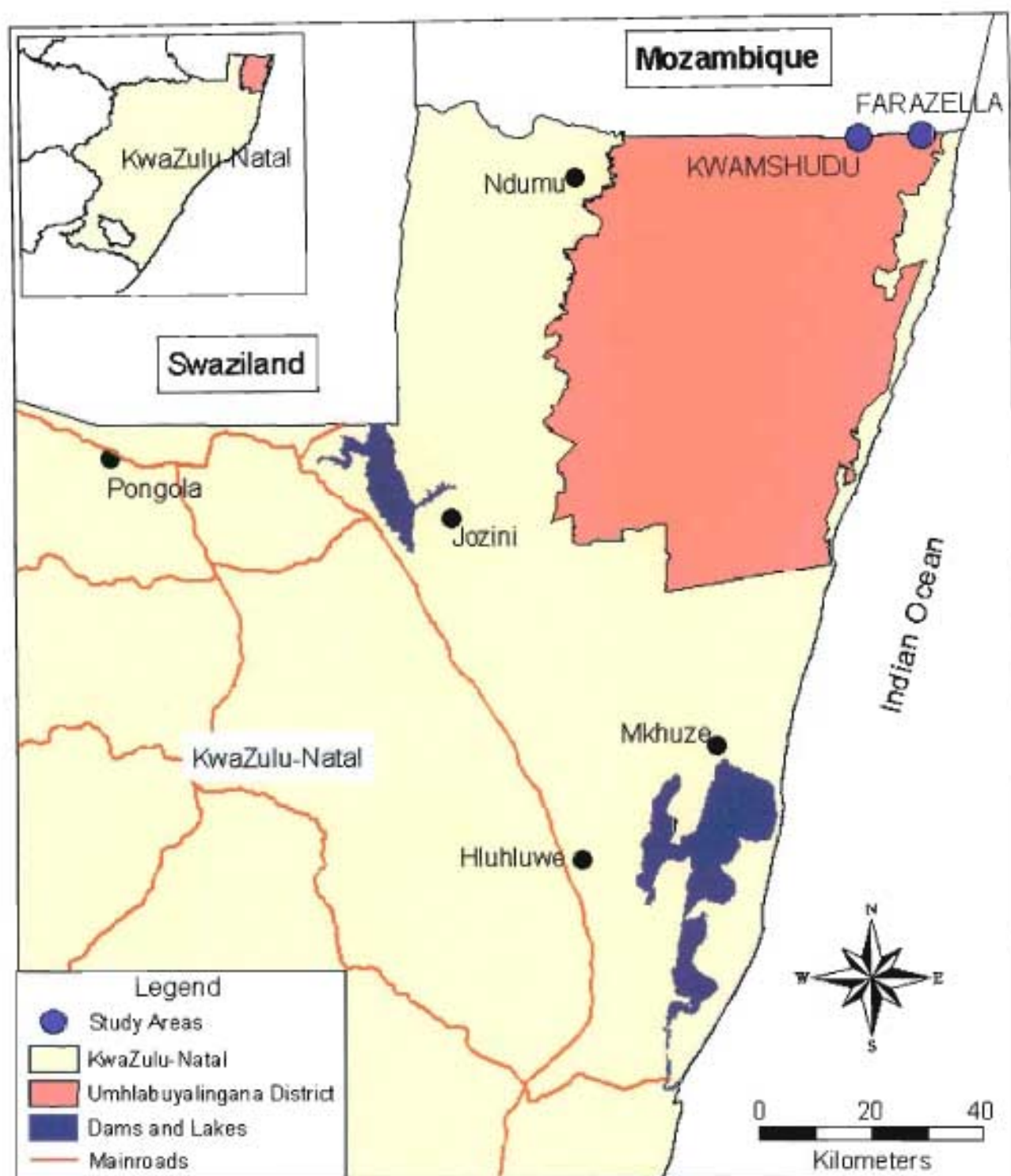


Figure 1.1: Location of Farazella and Kwamshudu within the Umhlabuyalingana Municipal District

These areas are approximately 150 m away from the Mozambique border, within the U.M.D. (Fig 1.1). The total area of this district is 3,693.40 km². The Umhlabuyalingana Municipal District falls under the jurisdiction of the Umkanyakude Regional Council in Northern KwaZulu-Natal. The nearest approved landfill site is in Hluhluwe which is 135 kilometres (direct distance) away. No basic services are provided to residents of these areas. Waste management is by means of communal dumps and unsightly littering. Groundwater is an important source of drinking water for the locals and water for domestic purposes is obtained from hand pumps and boreholes. The water table is approximately 1.2 m high. The S.A.N.D.F.'s waste management and sanitation practice threatens to contaminate this valuable source of groundwater and compounds the waste management problems already experienced in these areas. It is therefore vital to investigate alternative methods of waste disposal and sanitation.

1.7.2 Biophysiological Characteristics

The Zululand coastal plain has altitudes that range between 0 and 150 m. According to Thorrrington-Smith *et al.* (1998), the geology of the research area is characterised mainly by unconsolidated superficial deposits. The underlying soils are described as regosolic soils, which are derived from coastal sand dunes. Clanstall and Fernwood are the two soil types typically found in this area. Clanstall soils are dark, reddish brown, drain rapidly and have a moderate to severe erosion hazard (Thorrrington-Smith *et al.*, 1998). Fernwood soils in the orthic A-zone, are grey to dark grey and are poorly developed and highly erodible (S.A.S.A., 1999). Lubke and Mackenzie (1994) state that Fernwood soils are generally alkaline and are medium to coarse-grained.

This is a summer rainfall region that receives precipitation between 700 and 900 mm per annum. (Thorrrington-Smith *et al.*, 1998). The average temperature ranges from 26°C in January to 18 °C in June (Schulze, 1982). As depicted in Table 1.1 the mean annual temperature is 23 °C. Although the temperatures are not as high as inland temperatures, they are oppressive due to the relatively high humidity of the area.

The description of the vegetation in this area is based on the work of Acocks (1998). Originally this region consisted of forests. Today, however, it is characterised by open thornveld with many extensive patches of forest. Towards the coast the forest is short, very dense and tangled.

Month	Average Daily Temperature °C		
	Maximum	Minimum	Mean
January	32.5	21.4	26.9
February	31.8	21.4	26.6
March	30.9	20.5	25.7
April	28.8	18.0	23.4
May	27.0	15.2	21.1
June	25.2	12.2	18.7
July	25.2	12.0	18.6
August	26.6	13.6	20.1
September	27.8	15.8	21.8
October	28.5	17.1	22.8
November	29.9	18.9	24.1
December	31.6	20.4	26.0
Average Yearly Temperature	28.8	17.2	23.0

Source: D.E.A.T. (R.S.A., 1996)

Table 1.1 Mean Daily Temperature

Sanitation Practices	Percentage of Household
Flush Toilet	1.38
Pit Latrine	26.96
Bucket Latrine	0.49
No Toilet	70.39
Unspecified	0.81

Source: Statistics South Africa (2003)

Table 1.2 U.M.D. Household Sanitation Profile

Water Source	Percentage of Household
Piped to dwelling	2.49
Available on site	3.83
Public Tap	8.51
Tanker	1.22
Borehole	43.27
Natural	38.90
Other	0.86
Unspecified	0.87

Source: Statistics South Africa (2003)

Table 1.3 U.M.D. Household Water Source Profile

1.7.3 Socio-Economic Characteristics

The U.M.D. has a population of 122,340 of which 99% are African. The male-female ratio is 44.7% male to 55.3% female. In terms of the general population, sixty four percent are not economically active (infants, scholars, pensioners and homekeepers), while fifteen percent of the workforce are employed. Only 1.38 % of the households have flush toilets (Table 2), and only 2.49 % have piped water (Table 1.3).

The bio-physiographical and social characteristics of the study area have been briefly described above. Important factors such as the high water table, high poverty levels and the lack of municipal services are relevant to this study.

1.8 Structure of the Dissertation

Chapter one provides an introduction to the study. The aim and the objectives are followed by the location of the research area and a brief description of the bio-physiographical and socio-economic characteristics is also included.

Chapter two discusses the institutional framework of the S.A.N.D.F. This discussion is deemed necessary as it provides an orientation of environmental management within the S.A.N.D.F. structure. A brief discussion of the environmental management structure at the national and regional level concludes this chapter.

Chapter three reviews the methodologies employed in conducting this research. It examines the methodology used in the preparation for interviews and the construction of questionnaires and furthermore examines the techniques utilised in participant observations, conducting interviews and the administering of questionnaires.

Chapter four focuses on the theory of waste management, the sanitation situation in rural areas and provides a review of pertinent legislation. As the legislation reviewed embraces sustainable development, a definition of this concept is presented, which is then followed by a very brief discussion of the role of sustainable development in legislation.

Chapter five presents the results and findings of the research as well as an analysis of these findings. Views and experiences of senior and junior members of the S.A.N.D.F.

are presented. Thereafter the comments and suggestions of members external to the S.A.N.D.F. are presented.

Chapter six contains the conclusions based on the findings and discussions in chapter five, and recommendations are put forward. The current waste management and sanitation practices of the S.A.N.D.F. are in contravention of national legislation. Various short-term and long-term solutions are discussed, with a view to overcoming the shortcomings of the system as it exists.

CHAPTER 2

INSTITUTIONAL FRAMEWORK OF THE SANDF

2.1 Introduction

According to the White Paper on Defence (R.S.A., 1996), the responsibility for ensuring the exercise of proper ecological management of military property is vested in the Minister of Defence and the Chief of the Defence Force. This chapter provides a diagrammatic representation of the structure of the S.A.N.D.F. (Figure 2.1) and a brief explanation of the role and function of each level as indicated. Secondly, the history of environmental services in the S.A.N.D.F. is discussed and, lastly, the current structure of environmental management at national and regional level is provided.

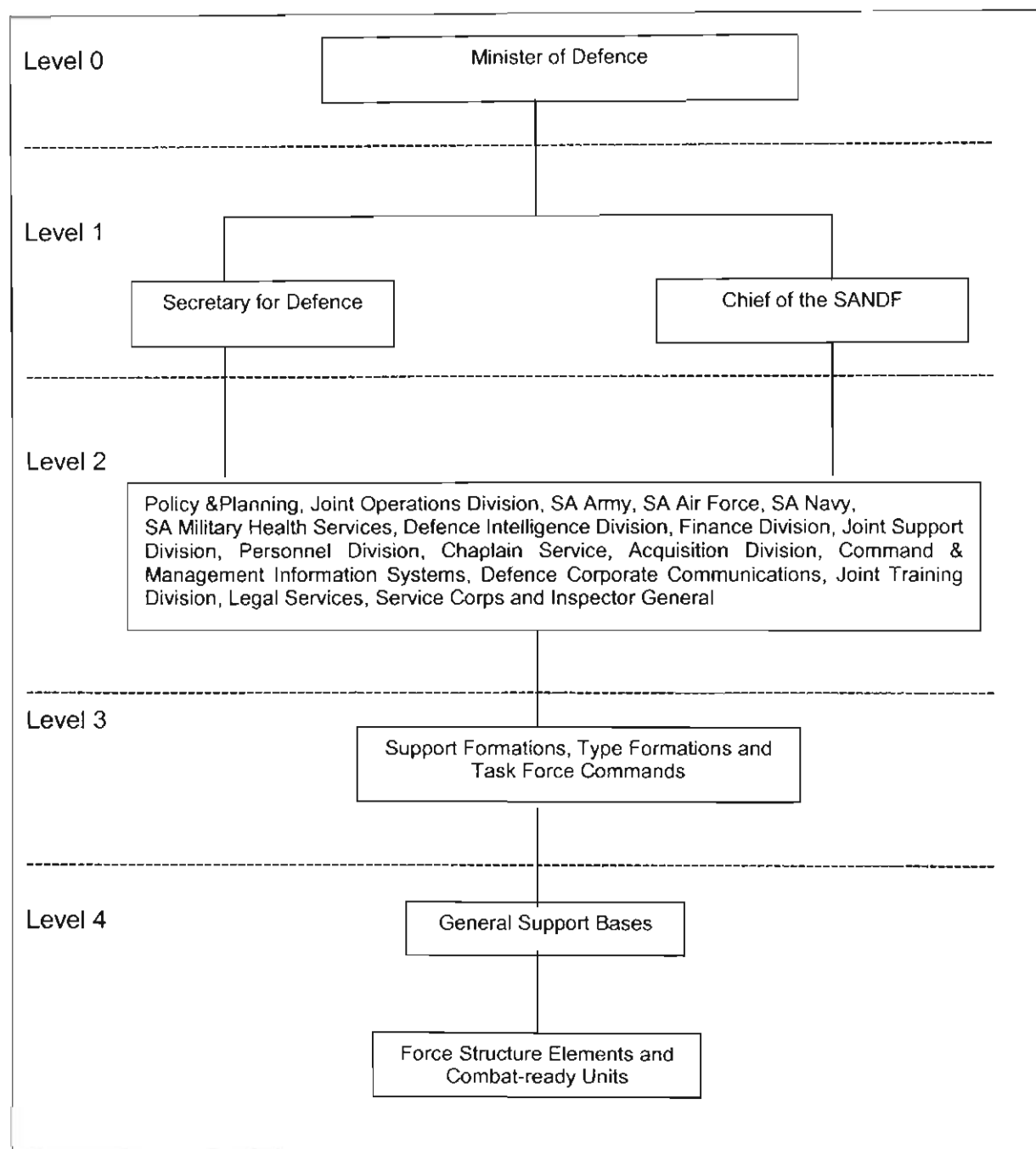
2.2 Structure of the Department of Defence

2.2.1 Level 0 and Level 1

The Minister of Defence is mandated by the Constitution to maintain control over and to be responsible for the entire Defence function (level 0). Civil control of the armed forces is exercised through the establishment of a Secretariat (headed by the Secretary for Defence), to support the Minister of Defence. The Secretary for Defence is the Head of the Department and the Accounting Officer, and his task is to provide the Chief of the S.A.N.D.F. with comprehensive instructions for the issuing of orders, directives and commands. The responsibility of the C.S.A.N.D.F. is thus to disseminate issue such orders and commands and to ensure that they are complied with as well as to oversee the execution of the budget (D.o.D. E.I.P., 2001).

2.2.2 Level 2

Corporate divisions that report primarily to the Chief of the S.A.N.D.F. are found at level 2. The strategy, planning and policy formulation of the S.A.N.D.F. is vested in these corporate divisions. The Joint Support Division is where environmental planning and policy formulation takes place (White Paper on Defence, R.S.A., 1996).



Source: D.o.D. E.I.P., 2001

Figure 2.1 Structure of the Department of Defence

2.2.3 Level 3

Three structures are found on level 3, i.e. Support Formations, Type Formations and Task Force Commands. The Task Force is responsible for the execution of specific operations and exercises. The task of the Type Formations is to prepare and develop combat ready units, while Support Formations are geared to provide support for the Type Formations (White Paper on Defence, R.S.A., 1996).

2.2.4 Level 4

The General Support Bases (G.S.B.) are located at level 4. They provide support to units, force structure elements and satellite offices in a specific geographical location (White Paper on Defence, R.S.A., 1996).

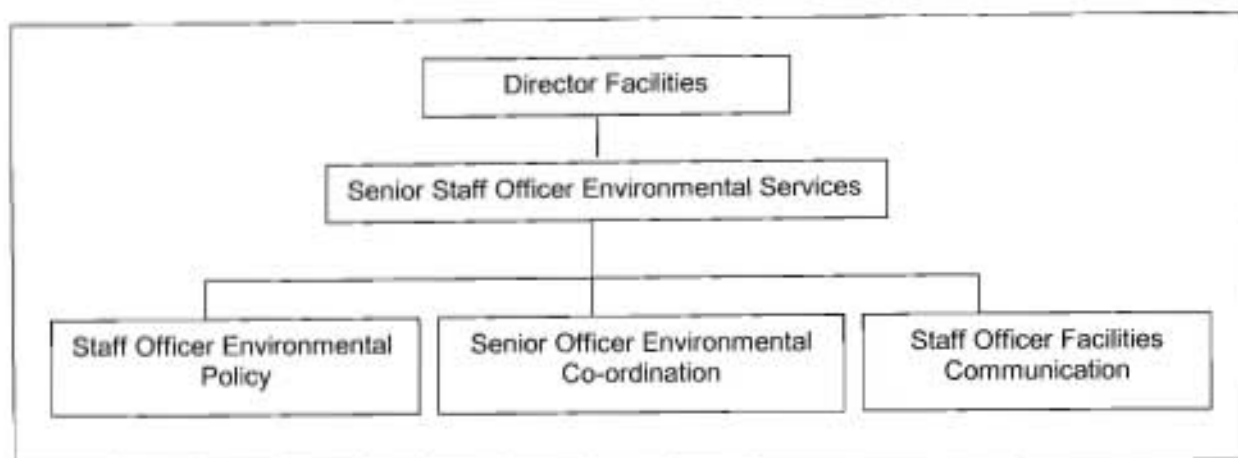
2.3 History of Environmental Services in the S.A.N.D.F.

In 1977, the Chief of the then South African Defence Force gave an instruction for the formulation of policy guidelines for environmental management. These guidelines were completed in 1978. Only one dedicated environmental officer was employed and he was assisted by qualified conscripted National Servicemen. The initial focus of these members was the fauna and flora found on military property. Subsequently, aspects such as base environmental management (including waste management), cultural historical conservation and environmental planning and education received attention. As an incentive for "good environmental management", an award programme was launched in 1983. The 1980's saw the development of a comprehensive long-term strategy for environmental services. In 1993, the National Service system was abolished and this led to the recruitment of additional permanent force officers. The inclusion of an environmental input into the Strategic Management Process started in 1999 (Godschalk, undated).

2.4 Structure of the Environmental Services Function

Joint Support Division (Director Facilities) on level 2 is the sub-directorate for Environmental Services. The responsibilities of this directorate include developing, formulating and promulgating environmental policies, procedures and guidelines.

Four permanent staff members are available for these responsibilities and the overall management of the environmental function, as depicted in Figure 2.2.



Source: *Godschalk et al. (1998)*

Figure 2.2 Structure of the Environmental Sub-Directorate at Division Headquarters

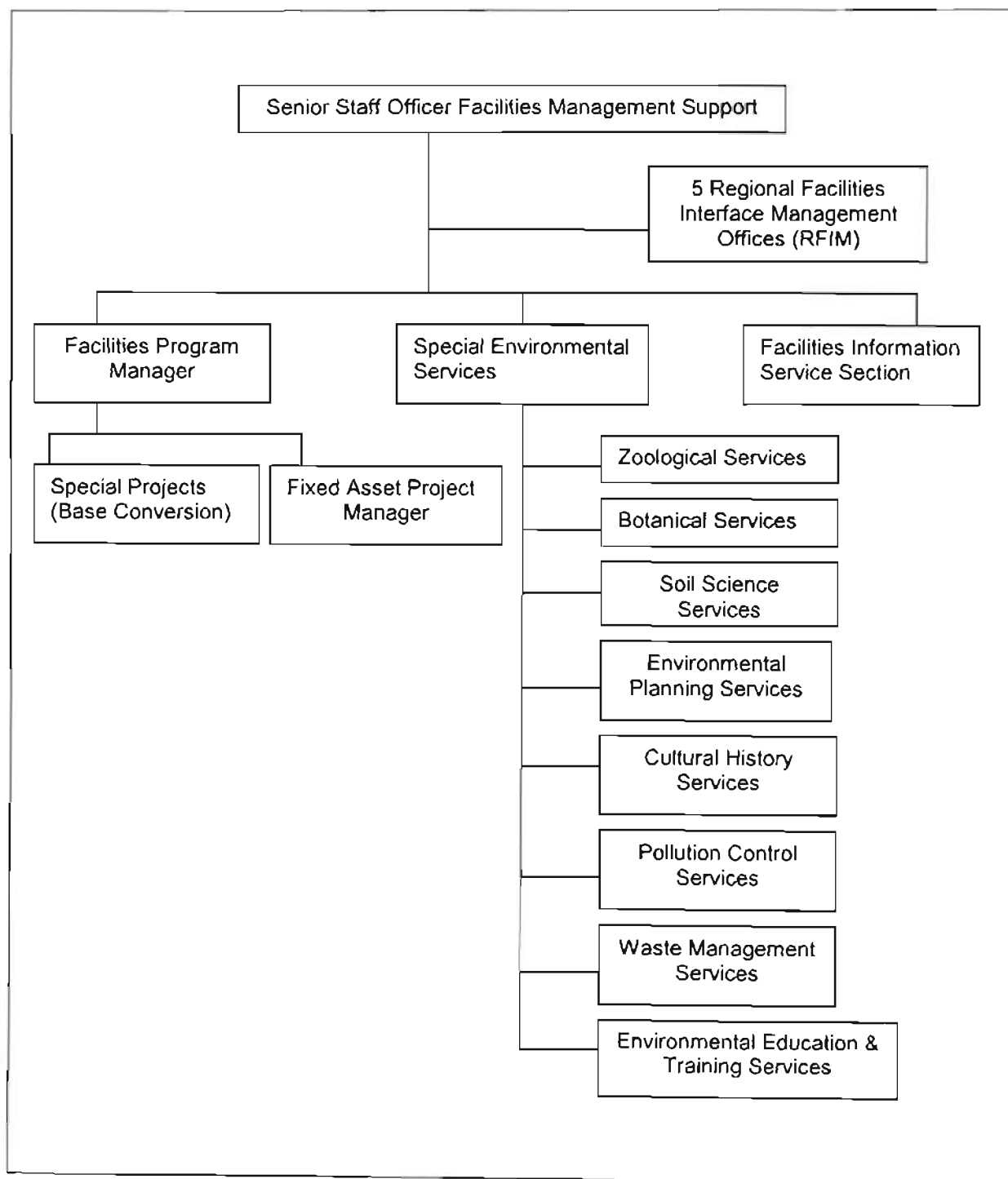
On Level 3 is the SANDF Logistic Support Formation. The Specialist Environmental team is located at this level and consists of nine specialists. The overall structure and management of environmental services at the S.A.N.D.F. Log Support Formation is depicted in Figure 2.3. The specialist team provides advice and assistance to the Environmental Managers at regional level

Each of the five Regional Facility Interface Management (RFIM) offices includes two dedicated environmental officers' posts. These members are qualified personnel who implement and monitor military integrated environmental management on a regional level. The regional offices are responsible for the nine regions as listed in Table 2.1

Regional Environmental Office	Area of Responsibility
Cape Town	Western Cape
Bloemfontein	Northern Cape Province and Free State
Durban	KwaZulu-Natal and the Eastern Cape
Pretoria	Gauteng and North West Province
Pietersburg	Northern Province and Mpumalanga

Source: *Godschalk et al. (1998)*

Table 2.1 Regional Environmental Offices' Areas of Responsibility



Source: Godschalk et al. (1998)

Figure 2.3 Structure of the Environmental Section at the Higher Headquarters

Each General Support Base at level 4 has at least one dedicated environmental officer available to support units, force structure elements and satellite offices for the management of the environment. In addition to this, there are other staff assigned to physically execute environmental management programmes.

The mission of environmental services is to ensure the environmentally sustainable management of military activities and facilities.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

The provision of basic waste management services and sanitation, especially to rural dwellers, is still a major challenge facing South Africa's democratically elected government. One of the first steps taken by the new government to meet this challenge was to enact legislation. As this study is aimed at determining whether current S.A.N.D.F. waste management and sanitation practices during deployments comply with legislative requirements, this chapter pays particular attention to these stipulations.

It has six parts and commences with an overview of waste management, including aspects on the sources of waste, the reasons for poor waste management and the accompanying social and environmental consequences. A discussion on sanitation follows focusing on groundwater pollution, which is a major environmental problem associated with poor sanitation. A comparative assessment of the waste management practices in developed and developing countries is then provided, and this highlights the differences in the quantities and composition of waste as well as the reasons for these differences.

Currently strong ties exist between the R.S.A. Department of Defence and the United States Department of Defence (U.S.A. D.o.D.). A collaborative process has started between the two government D.o.D. structures, which has led to an extension of knowledge in the field of environmental management. The R.S.A. Chief of Joint Support and the Policy and Planning Section have regular meetings with their counterparts in the U.S.A. D.o.D and have formed an Environmental Security Working Group, R.S.A.-U.S.A. Committee. As a result of this co-operation, the Military Integrated Training Range Management Guidebook was compiled. One of the current projects of the committee is to present a course on Integrated Waste Management in 2004 (Godschalk, 2003). The U.S.A. D.o.D. Mobile Environmental Training Team will offer this course to environmental managers in the R.S.A. D.o.D. and its content will be based on the current methods of waste management in the U.S.A. D.o.D. The review

of the waste management practices in the U.S.A. D.o.D. in the fourth part of this chapter is thus appropriate.

Although, at present, there is no R.S.A. S.A.N.D.F. waste management policy, a review of various defence policies, which include aspects of waste management, is considered thereafter. The final part of this chapter reviews the policies and legislation that form the regulatory framework for waste management. As they all embrace the concept of sustainable development, the ensuing implications are explored.

3.2 Waste Management

3.2.1 Definition of Waste and Pollution

There are numerous definitions of waste. Table 3.1 lists three such definitions utilised in different countries.

United States of America	United Kingdom	Republic of South Africa
<p>" A waste is a moveable object which has no direct use and is discarded permanently"</p> <p>(Le Graga <i>et al.</i>, 2001:2)</p>	<p>"any substance which constitutes a scrap material or an effluent or surplus substance arising from the application of any process; or any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled, but does not include a substance that is explosive"</p> <p>(Pike and Phillips, 1998:6)</p>	<p>"an undesirable or superfluous by-product, emission, residue or remainder of any process or activity, any matter, gaseous, liquid or solid or any combination thereof, originating from any residential, commercial or industrial area"</p> <p>(Government Gazette No 12703, 1990:25)</p>

Table 3.1. Definitions of Waste

The definition provided by the Government Gazette No. 12703 (1990:25) is highly respected and is utilised by Fuggle and Rabie (1992) and Glazewski (2000) in their study.

The definition of pollution, as cited in the White Paper on Integrated Pollution and Waste Management for South Africa (R.S.A., 2000:4), is: "the introduction into the environment of any substance property (including radiation, heat, noise and light) that has or results in direct harmful effects to humanity or the environment, or that makes the environment less fit for the intended use".

3.2.2 An Overview of Waste Management

The existence of humans within their environment results in activities that lead to the generation of different types of waste. This waste ultimately lands up in one of three natural depositories, i.e. land, air or water. Waste can be classified according to its source of origin. Cointreau-Levine (1982), cited in Adedipe (2002), categorises waste as follows:

- (i) **Household wastes:** Organic waste from the kitchen and small portions of plastic, packaging (including cardboard), rubber, garden waste and sweepings and discarded furniture and appliances. Domestic waste attracts flies, rats and pathogenic bacteria in addition to emitting unpleasant odours.
- (ii) **Commercial refuse:** Packaging (cardboard, plastic, metal, and wood) which originates from offices, shopping complexes, hotels and restaurants. Waste originating from markets is mostly organic in composition.
- (iii) **Institutional refuse:** Originating from government offices, schools and hospitals consisting of writing paper and food waste. Hospitals and health care facilities generate medical waste that requires special handling, storage and disposal.
- (iv) **Street sweepings:** consist mainly of sand, stones and litter. Appreciable amounts of household refuse, leaves, paper, drain cleanings and human and animal excreta may also be included.
- (v) **Construction debris:** Originates from construction and demolition activities and includes industrial waste.

Waste generated in the research area consists of small packaging and cardboard, thus this study focuses on household waste.

Numerous environmental and public health problems arise due to the lack of municipal waste management services. The initial consequence is an accumulation of refuse. Besides being aesthetically unsightly, decomposing refuse results in unpleasant odours. Refuse dumps also serve as a habitat for the breeding of flies, cockroaches and rodents, which spread diseases to humans. Nyandu (1998) notes that diarrhoea, cholera, hepatitis and skin and eye infections are the main public health problems associated with environments that are polluted with waste. In their study Hannien and Rautanen (2002) found diarrhoea to be the most dangerous killer disease amongst children in developing countries. By contrast, the Centre for Disease Control and Prevention in the United States, a developed country where the accumulation of waste in the environment is not a major problem, found the three leading causes of infant mortality to be congenital malformations, low birth weight and sudden infant death syndrome. (<http://www.cdc.gov/nchs/fastats>)

The lack of waste removal or inadequate waste management is not only a threat to public health, but can also cause damage to the infrastructure of the urban environment, e.g. blockage of stormwater drainage, resulting in repair or replacement costs (Lombard and Lombard, 1996)

According to Cointreau-Levine (1994), solid waste management is the responsibility of local government. Cointreau-Levine (1994) goes on to state that such a service should be non-exclusive, i.e. the service should be provided to all, including those who do not pay for the service, as public health and environmental protection are in the overall interest and welfare of the public. In many instances, we find that local government is not able to provide this service to all, as is the situation in the research area. Cointreau-Levine (1994) suggests that co-operation between the public and private sector can alleviate this problem and can also result in cost saving and the provision of expert knowledge that is lacking at local government level.

Adedipe (2002) argues that poor and inefficient waste management must be addressed by all levels of government. "Efficient solid waste management requires human endeavour and affects and interacts very closely with both the conservation and the

preservation of our environment on the one hand, and the conservation of materials and energy on the other” (Simpson, 1994:3). Thus, the purpose of solid waste management is to protect public health and to preserve the environment.

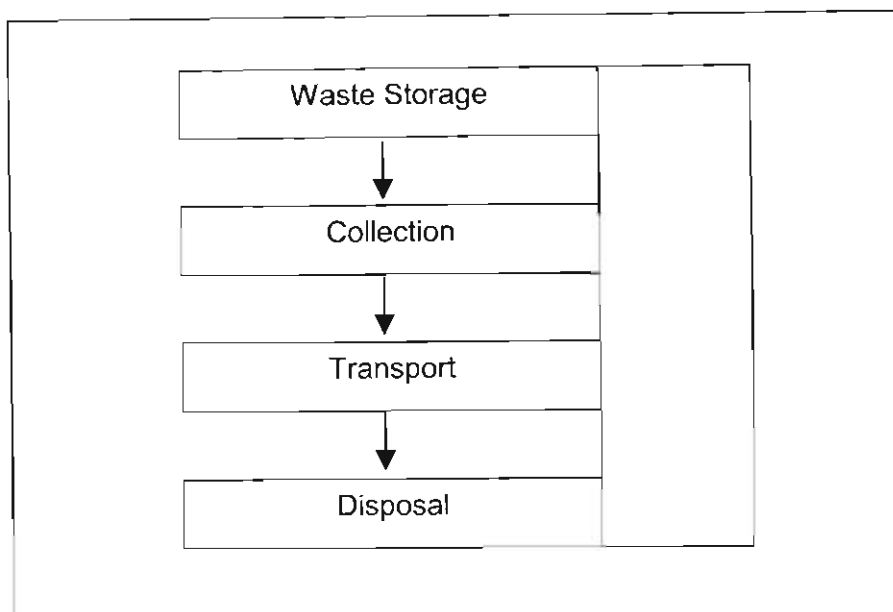
Tieran (1999) found that there is no single, effective waste management system, and that the use of many systems that complement each other, providing sound and cost effective waste management, must be considered. A model of the waste management process is depicted in Figure 3.1, which contains the basic components of a waste management system. To this end, an understanding of the waste management process is necessary and will be discussed below.

3.2.3 The Waste Management Process

A waste management system is established to remove waste from living areas, in order to protect public health and to maintain a high quality of life. Figure 3.1 is representative of a waste management strategy. Different models exist in various sources of literature (Fuggle and Rabie, 1992), but they all contain the basic components, i.e. waste generation, storage, transportation and disposal. A popular misconception amongst managers is that the management of waste entails waste disposal. Thus the important aspects of waste generation, storage and transportation are overlooked in waste management. The result of this oversight is the mismanagement of waste, which leads to pollution of the environment. In order to understand the waste management process it is necessary to describe each component of this process.

According to Palmer (1996), the key aspects of waste generation are source of waste generated, amount of waste generated, characteristics of waste generated and waste reduction or minimisation. These aspects are important, as they will impact on waste management planning i.e. storage, collection, transportation and disposal.

The classification of waste at this stage in the waste management process is important, as it will influence the handling of the waste. As stated above, different activities produce different types of waste. Hazardous waste will require specialised storage, collection, transportation and disposal and is much more costly than the handling of non-hazardous waste.



Source: Ball and Associates, 1999

Figure 3.1. The Elements of Basic Waste Management Systems

3.2.3.1 Waste Generation

Although this category of waste is not dealt with in this study, a definition is provided. The definition of hazardous waste in La Graga *et al.* (2001:2) is as follows: "Hazardous waste means (solids, sludges, liquids and containerised gases) other than radioactive (and infectious) wastes which, by reason of their chemical activity or toxic, explosive, corrosive, or other characteristics, cause danger or likely will cause danger to health or the environment whether alone or when coming into contact with other waste". According to Bosman (1998), there is no internationally accepted approach to waste classification and, in South Africa, waste classification is based on the risk to the environment, i.e. the biophysical and the socio-economic environments.

In his study Bosman (1998) clearly divides the categorisation of waste into two main areas (Figure 3.2). Step one - The waste manager must determine whether or not the waste really needs to be discarded into the environment or whether it can be recycled. This step is the primary classification of waste. Step two - Once all the options in step one have been exhausted and the waste must be discarded by landfilling, then the class of landfill must be determined, i.e. the landfill that will be best suited to handle the effect of the waste on the environment should be selected. This step is known as the secondary classification or the de-listing step. The waste generated in the research

area, chosen for this study, is not hazardous and will be managed according to step one. If it is not recycled or re-used, it can be disposed of at a general landfill site.

3.2.3.2 Waste Storage

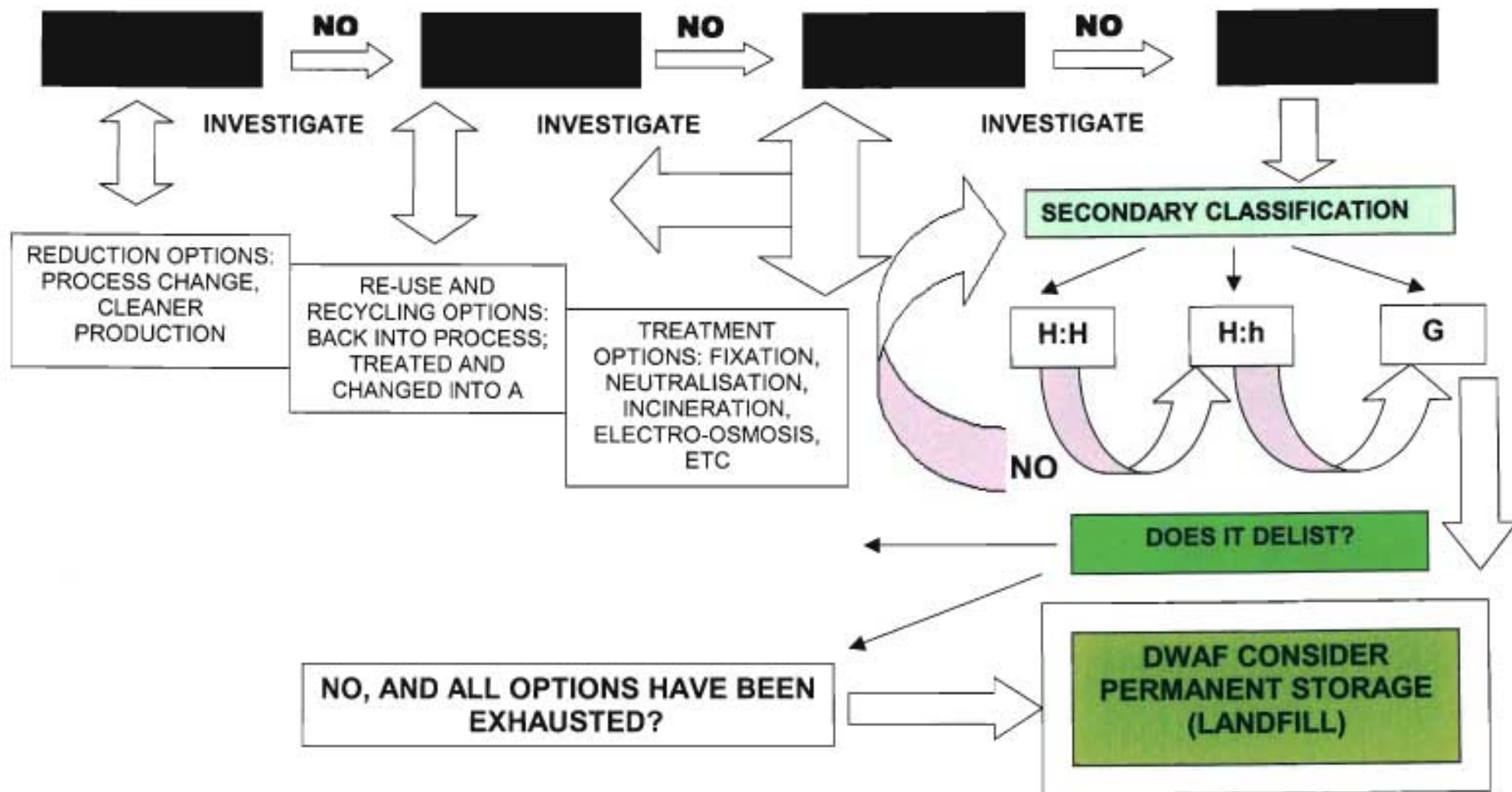
Domestic waste is stored at the residence concerned and requires bins with close-fitting lids to protect public health and maintain high environmental standards. It is therefore necessary to remove waste regularly to prevent insect and rodent infestation. In commercial enterprises and flats the common complaint with storage is that it takes up too much space (Tworeck, 1979). In their study Fuggle and Rabie (1992) found that waste storage in the waste management process is very poorly planned for in the building of factories and flats. The factors that must be considered when designing on-site storage are the type of collection system and the method of recycling.

C.S.I.R. guidelines (1994) provide for on-site storage and disposal of waste in townships and the rural areas by digging a pit. This waste must be covered with a layer of sand every day to prevent the breeding of pests. In such instances, caution must be exercised with the disposal of medicines and old batteries that could pollute ground water.

3.2.3.3 Waste Collection

According to Fuggle and Rabie (1992: 497), the following factors must be considered in waste collection: "collection vehicle system, manpower, collection routes, public health, bylaws and regulations, and aesthetics". In rural areas, communal collection is a feasible option due to the absence of roads or poor road conditions. Waste can be brought to these points by the householders or by local "entrepreneurs" who fetch the waste from the households and deliver it to the collection points (Palmer, 1996). Residents in the urban environment are required to place their waste at the entrance to their properties for collection. If recycling is active in the area, different types of waste may be taken away separately. In South Africa, the minimum frequency of collection in residential areas is once a week (Tworeck, 1979).

PRIMARY CLASSIFICATION: WHAT ARE THE CONSTITUENTS? WHAT IS THE HAZARD RATING?



Source: Bosman (1998)

Figure 3.2 Managing a Waste Stream: Hierarchy of Options to Consider

3.2.3.4 Waste Transportation

Urban areas make use of a motorised collection system. Waste is compressed in the vehicle prior to removal to the landfill site. The advantage of this system is that more space is available and thus the number of trips to the landfill site is reduced. (Nath *et al.*, 1993). Palmer (1996) mentions that in developing countries, transportation of refuse in the absence of motorised vehicles can be by hand carts, animal drawn carts, and pedal tricycles. These methods of transportation have low operating costs and operate over short distances.

3.2.3.5 Waste Disposal

Various options are available for waste disposal and these include incineration, landfill, composting, isolation from the environment, recycling, etc. The incineration, landfilling and the recycling of waste are considered below as a prerequisite to discussing waste management in the research area. Open burning is the current method of waste disposal in the research area. The refuse is placed in a trench and is burnt at the end of the day. According to Fuggle and Rabie (1992), the trench and fill method utilised for small daily amounts of waste is generally adequate, provided that the burnt residue is well covered.

Incineration is defined as “the controlled burning of solid, liquid or gaseous combustible wastes, so as to produce gases and residues containing little or no combustible material” (Patrick, 1980:254) cited in Nath *et al.*, 1993. The Royal Commission Report on Environmental Pollution of May 1993, cited in Tieran (1999), encourages incineration of refuse and considers incineration to be the best practical environmental option. According to this report, incineration of waste can be utilised to recover energy present in household waste, and incineration also prevents waste from decaying and producing methane (green house gas), hence this process assists in countering the green house effect. Nath *et al.* (1993) also found that burning reduces the volume of the waste by a factor of ten or more and that the objectionable characteristic of household waste, i.e. putrescibility, pathogens and flammability can be completely eliminated. However, incineration of waste is a complex technical process that requires skills for the operation and the maintenance of such a system, in order to comply with strict emission standards (Nath *et al.*, 1993).

The D.W.A.F. have recommended the use of the litergon incinerator as an alternative to the open burning of waste in the research area (Joubert, pers. comm., 2002).

Pike and Phillips (1998: 50) describe a landfill site as "an engineered void into which compacted solid waste is tipped and buried". Landfill-based disposal is cost effective, has minimal adverse effects on the environment and is the most appropriate method for a developing country such as South Africa (Fuggle and Rabie, 1992). Leachate is a major problem associated with landfilling (Nath *et al.*, 1993). Leachate is defined as "being the liquid emission resulting from the bio-decomposition processes of a landfilled waste body, and the flushing of liquids (predominantly rain water) through the waste" (Strachan, 1999:3).

In dealing with accumulated waste storage, collection and disposal are the components of a basic waste management system. It is also important to focus on integrated waste management, which is aimed at the management of waste in a sustainable manner. Table 3.1 depicts the elements of an integrated waste management strategy.

Waste Hierarchy	
Cleaner Production	Prevention
	Minimisation
Recycling	Re-use
	Recovery
	Composting
Treatment	Physical
	Chemical
	Destruction
Disposal	Land fill

Source: Draft South African National Waste Management Strategy (1999)

Table 3.2. The Elements of the Waste Management Hierarchy

Lombard and Lombard (1996) mention that, in order to put an end to the conventional methods of coping with waste, aspects such as waste minimisation, reduction and recycling must be included in the overall management strategy. Pike and Phillips (1998) provide some practical examples for each approach in Table 3.2. By avoiding double wrapping on goods, for example, waste will be reduced. Moreover, if production processes are improved, this will minimise the reject rate and decrease the exploitation

of natural resources. An example of recycling in industrial processes is the installation of a pump that will recycle cooling water instead of it running as a waste effluent.

Alternatively, treatment could entail the incineration of waste in an “energy from waste” plant. Finally, landfilling is a means whereby waste is stored or disposed of in a controlled manner. Pike and Phillips (1998) state that avoidance should be a priority and disposal the last resort. Ball (1999) argues that even though this approach cannot be applied in developing countries, where a basic waste management system is not in place, it would be relevant in the progressive upgrading of a basic waste system at a later stage.

Second in importance, after cleaner production in the waste management hierarchy, is recycling, as the other options have major impacts on the environment. Leachate from landfills may result in groundwater contamination, while land filled sports fields could cause cancer and incinerator plants pollute the air (Goeschl, 1998). According to Parkin (1995), the benefits of recycling on the other hand are numerous. This process is an important source of raw materials and saves on the use of natural resources. It assigns monetary value to waste as well as reducing the amount of waste that needs to be disposed of, which in turn extends the life of existing landfills and delays the need to seek new landfill sites. In addition to these benefits, Clarke (2002) reports that informal recycling results in poverty relief.

According to Bredenkamp and Wates (1998), the status of recycling in South Africa is market driven. Discarded materials originate from schools, offices and residential waste. Clearly, source separation of waste would facilitate the process as collection is done mainly by private contractors who deliver to agents in metropolitan areas. Many local authorities actively promote this system to reduce the amount of waste coming to landfill sites, but numerous projects have failed, owing to an overestimation of the value of recyclables. However, although the amount of money generated may not be much, Parkin (1995) advises that the environmental benefits must not be overlooked. Table 3.3 provides the latest statistics on recycling in South Africa and illustrates that, since 1990, there has been an increase in the amount of materials being recycled (Wates and Bredenkamp, 1998).

	PAPER		PLASTICS		GLASS		TINPLATE		ALUMINIUM	
	1990	1996	1990	1994	1990	1996	1990	1996	1990	1996
Total available for Consumption (thousand tons)	1870	1885	625	740				316	128	118
Total converted into Packaging (thousand tons)	850	818	240	355	459	350	269	261	21	31
Amount recycled (thousand tons)	340	673	70	135	64	79	65	129	34	37
Percentage packaging recycled	40%	82%	29%	38%	14%	23%	21%	49%	100%	100%
Percentage recycled (relative to total production)	18%	36%	11%	18%				43%	27%	31%

Source: Bredenkamp and Wates (1998)

Table 3.3. Recycling of Material in South Africa. A comparison of data for 1990 and most Recent Available Figures

A discussion of the recycling trends as discussed by Bredenkamp and Wates (1998) follows:

Paper and Board - Forty-three percent of the paper and board produced is utilised in the packaging industry. Eighty-two percent of this is recycled, which translates to an increase of eighteen percent over the period of 1990 -1996.

Plastics - Forty-eight percent of the plastics produced is utilised in the packaging industry. Eighteen percent of this is recycled, representing an increase of seven percent between 1990 and 1994.

Glass - It is difficult to estimate the percentage of glass used in the packaging industry and the amount that is recycled. The reason for this is that 31% of glass containers utilised in the packaging industry have a deposit attached to them. These containers are then refilled approximately twenty to thirty-five times before they are discarded. The baseline study estimates that 23% of the amount of glass available in the packaging industry is recycled and that this percentage has also increased between 1990 and 1996.

Tinplate and Aluminium - Eighty-two percent of the tinplate and aluminium produced is utilised in the packaging industry. Forty-three percent of this amount is recycled.

The preceding discussions describe a theoretically acceptable manner in which waste should be managed and provide a useful point of departure for the assessment of the waste management process of the S.A.N.D.F. in the research area.

3.3 Sanitation

3.3.1 Introduction

Sanitation refers to the collection, removal and disposal of human excreta, household wastewater and refuse and is a system that will promote hygiene, healthy living conditions (D.W.A.F., 2002). This study also focuses on how human excreta is dealt with. In the words of Ellis (1999:127): "Sewerage consists of human faeces and urine, smells, looks awful and carries diseases". According to Alcock (1999), domestic sewerage is not only composed of faeces and urine, but also foreign objects such as newspaper, rags, toilet paper, tampons, condoms, cigarettes and so forth.

Sanitation requirements in developing countries are inadequate and in South Africa an estimated eighteen million people, i.e. 40% of the total population do not have access to basic sanitation. The Central Statistical Service cited in Alcock (1999:21,22) defines five categories of sanitation systems which are described as follows: "no facility, pit latrines (probably unimproved pit latrines), latrines with a bucket system, flush/chemical toilets in the yard, and flush/chemical toilets in the dwelling". A discussion on the sanitation situation in the R.S.A. and the problems associated with poor sanitation follows. The exploration of this topic and the literature relating to it is necessary as it illustrates the plight of rural Black people who do not have access to sanitation. It also highlights the multitude of diseases associated with this problem.

3.3.2 An Overview of Sanitation in the R.S.A.

Palmer (1993), cited in Alcock (1999), conducted a study on urban sanitation that focused on blacks in the former homelands and national states. Palmer (1993) found that sanitation in these areas was far from satisfactory.

However the plight of rural Black people is far worse and Table 3.4 reveals statistics reflecting the situation. These statistics were compiled by research conducted by the Palmer Development Group and Makhetha Development Consultants (1995) cited in Alcock (1999).

System	System available (percentage of sites)		Percentage of the rural population using given facility
	Schools	Clinics	
Full waterborne sewerage	0.0	0.4	0.1
Septic tanks/LOFLOS	8.2	44.6	4.6
VIP latrines	2.8	3.7	0.2
Bucket (night soil) latrines	1.1	0.0	0.5
Unimproved pit latrines	59.9	51.3	64.4
No toilet available	28.0	0.0	30.2
Total	100.0	100.0	100.0

Source: Palmer Development Group and Makhetha Development Consultants (1995) cited in Alcock (1999)

Table 3.4 Sanitation systems at schools, clinics and households in rural areas of South Africa, 1993.

The health problems associated with poor sanitation are diarrhoea and dysentery; typhoid; bilharzia; malaria; cholera; worm infestation; eye infections and skin diseases; and increased risk from bacteria, leading to infections and disease for people with reduced immune systems due to HIV/AIDS. Annually, 1.5 million cases of diarrhoea are reported in children under the age of five in South Africa (D.W.A.F., 2002).

According to D.W.A.F. (2002), groundwater pollution is a major environmental problem associated with the lack of proper sanitation, especially if on-site sanitation is situated close to boreholes or in areas with a high water table. The study of groundwater contamination in developing countries conducted by Hiscock (2000) supports these findings. The sanitation system of the defence force in the study area consists of unimproved pit latrines. As mentioned in chapter one, this area is characterised by a high water table.

Fuggle and Rabie (1992) state that, as freshwater lakes are virtually non-existent in South Africa, fresh water supply is confined to rivers, dams and groundwater. The average annual rainfall of South Africa is 500 mm per year and the country is therefore categorised as semi-arid (Clarke, 2002). Clarke (2002) therefore concurs with Fuggle

and Rabie (1992) that fresh water is a scarce resource in South Africa. It is therefore a matter of great concern that research conducted in developing urban settlements by Wright (1999) found that human activity has the potential to contaminate groundwater. Six activities were investigated and among these were on-site sanitation systems and garbage disposal and collection sites. Wright (1999) also found that extensive groundwater contamination had occurred in unconfined aquifers in the coastal zone.

According to the study by Wright (1999), the most significant pollutants were nutrients, particularly nitrogen and phosphorous; pathogenic organisms such as helminthes, protozoa, bacteria and viruses and biodegradable organic substances like proteins, carbohydrates and fats. Simpson (1990), cited in Alcock (1999), attributed the poor bacteriological quality of groundwater to leaking sewers. Inadequate or no sanitation will have similar consequences to these listed above. According to Hiscock (2000), once polluted, groundwater cannot be rehabilitated and thus the protection of groundwater is vital. In the light of the above findings, the SANDF should urgently source viable methods of sanitation.

The target for clearing the backlog in sanitation is March 2010: i.e. by then all South Africans must have a minimum level of sanitation. The provision of sanitation and a basic water supply will alleviate other poverty-related issues in addition to the environmental and public health problems, thus securing an acceptable quality of life for all South Africans.

3.4 International Trends in Waste Management

3.4.1 Introduction

This section highlights the trends of waste management in developed and developing countries. Exploring this body of literature highlights the differences in waste management between developing and developed countries, and suggests reasons for these differences. This information is important as it makes it apparent that the development of any waste management system will need to consider the prevailing socio-economic and environmental factors.

3.4.2 A Comparative Analysis of Waste Management in Developed and Developing Countries

The use of technology and stringent legislation to manage waste is common in many developed countries. According to Horan (1996), there is intensive research in the field of waste management in addition to strict legislation, which is aimed at increasing the efficiency of traditional waste management and the development of alternatives. As demonstrated by Horan (1996), research is focused on waste minimisation, water re-use and clean technology and recycling and it is hoped that this document will facilitate compliance with the rigorous demands of legislation. Similar trends are reflected in the U.S.A., i.e. stringent legislation has led to research for innovative improved methods of waste management. Cheremisinoff (2001) states that non-compliance to environmental statutes means fines, penalties or imprisonment of the company's Chief Executive Officers and the loss of business, which has been a driving force for improvements in waste management.

Developed countries also place emphasis on recycling, by imparting increased responsibility on and encouraging participation of citizens in waste management. In most developing economies, however, the provision of a basic waste management system is either absent or inadequate. The focus of these countries is therefore on the improvement or extension of existing services. As proposed by Palmer (1996), the responsibility for the provision of waste services in advanced as well as in less developed countries, lies with the local Government. At present, the collection and removal of waste is conducted by the public or private sector. Table 3.5 provides a comparison of the characteristics of waste in developed and developing countries (Palmer, 1996). Affluent life styles such as those in the U.S.A. produce greater quantities of waste in comparison with that generated by poorer people. Table 3.6 illustrates this trend and highlights the throw-away lifestyle of people in developed countries where the kilo of waste per capita is greater than that found in emerging economies.

	DEVELOPED COUNTRIES	DEVELOPING COUNTRIES
Per Capita	Generation rates usually exceeds 1 kg per day	Generation rates are generally below 0.6 kg per day.
Density	Usually no greater than 150 kg per cubic metre	Usually greater than 400 kg per cubic metre
Composition	Large amounts of paper. Metals, glass, plastics and *putrescibles	Large amounts of putrescibles, dust and ash

*Putrescibles are wastes that decay or rot.

Source: Modified from Palmer et al.. (1996)

Table 3.5 Waste generation in Developed and Developing Countries

Municipal Waste (kg/capita) (1997)		Waste Composition (%) (1993)					
		Paper and Paperboard	Food and Garden waste	Plastics	Glass	Metals	Textiles
USA	730	38	23	9	7	8	16
Canada	630	28	34	11	7	8	13
France	560	30	25	10	12	6	17
Denmark	520	30	37	7	6	3	17
Japan	410	46	26	9	7	8	12
Turkey	390	6	64	3	2	1	24
Spain	370	21	44	11	7	4	13
Iran	324	8	74	5	3	1	2
Mexico	320	14	52	4	6	3	20
Greece	310	20	49	9	5	5	13
Poland	290	10	38	10	12	8	23
China	285	3	60	4	1	0	2

Source: Powell and Craighall (2000)

Table 3.6 Generation and composition of municipal waste for selected countries

According to Clarke (2002), South Africans generate 28 million tons of domestic refuse per year in proportions that can be seen in Table 3.7.

Type of Waste	Percentage
Food	33
Paper	28
Glass	11
Metal	6
Plastics	8
Unclassified	14

Source: Clarke (2002)

Table 3.7 Composition of waste generated in South Africa

According to Powell and Craighall (2000), waste management issues in developed countries are: the siting of new landfill sites, formulating policies directed at the packaging industry and aimed at reducing the overall impact of packaging, and managing the huge number of old vehicles. Palmer (1996) cites the absence of policies and the lack of planning for waste management, to be crucial problems affecting refuse control in developing countries and also states that the use of technology for managing waste is limited, as the necessary skills are absent. Cheremisinoff (2001) asserts that the globalisation of industries will propel the governments in developing countries to create effective frameworks for waste disposal, which will include the use of cleaner technology.

Emerging economies can adopt methods used successfully in developed countries to address their refuse problems. Recycling, community education and empowerment would be useful to them, but in such countries the priority should be to enact legislation and to provide the finances for a basic waste management service to its citizens.

3.5 Waste Management in the United States of America Department of Defence (U.S.A. D.o.D.)

3.5.1 Introduction

The review of this body of literature makes it clear that it is necessary for the U.S.A. D.o.D. to adhere to national waste management legislation, as represented in the

Resource Conservation and Recovery Act of 1996. In response to this act, the U.S.A. D.o.D. formulated the Solid Waste Management Guide of 1990 and went even further by providing appropriate guidelines for the management of waste by specific waste generators.

3.5.2 An overview of Solid Waste Management in the Departments of the Army, the Navy and the Airforce.

The U.S.A. D.o.D. departments of the Army, the Navy and Airforce must all conform to the Solid Waste Management Guide of 1990, henceforth referred to as S.W.M. (1990), to ensure uniformity of waste management in these departments. The seven legal requirements of the R.C.R.A., i.e. handling and storage of solid waste, refuse collection, transfer stations, sanitary landfills, volume reduction techniques, resource recovery and recycling are included in the aforementioned guide. It is a comprehensive D.o.D. guide that includes policies and procedures for solid waste management. The design and operation of incinerators must conform to the guidelines of the Environmental Protection Agency, the Clean Air Act, the Clean Water Act and relevant state regulation. The S.W.M. (1990) serves as a primary guide to solid waste management. It provides the following general objectives aimed at maintaining high environmental standards.

- **Environmental Protection:** To protect health and the environment by the sanitary removal of waste.
- **Convenience:** To provide optimum levels of service, i.e. w.r.t. frequency of removal and collection points.
- **Continuity:** A stable service is essential. A contingency plan must be in place for times when there is an interruption of collection services.

This directive views the education of base personnel in waste management as essential. All regulations with regard to waste must be filtered down to base personnel. It is important for legal compliance purposes that the list of waste material that cannot be sent to the landfill or be incinerated must be made available to the base members, as landfill sites are inspected by environmental regulatory agencies. The base

newsletter communicates relevant information to base personnel. As regulations with regards to hazardous waste are becoming increasingly stringent, it is necessary to have frequent information updates. Education on the handling and storage of hazardous waste is thus compulsory for all new base personnel. In the R.S.A., S.A.N.D.F. personnel are informed about waste management during basic training.

The U.S.A. D.o.D. makes use of transfer stations in waste management. Transfer stations are intermediate waste storage facilities, which are utilised in the following instances: when there is limited access to restricted military base areas, when disposal sites are more than ten miles from the collection route and if collection trucks have a small capacity. In some instances, contractors are employed to remove waste to the disposal site. The research area is 135 km away from the nearest waste disposal site and the establishment of a transfer station would therefore be a practical and a financially viable option.

In the U.S.A. D.o.D., the Army, Navy and Airforce, in addition to the above Directive, took the initiative to formulate their own guidelines on waste management, as listed below.

- **Army:** *AR 420-47, Solid and Hazardous Waste Management* – This document allocates responsibilities and defines regulatory requirements for the safe environmental management of solid and hazardous waste in the army. It contains the procedures for collection, storage and disposal of solid waste.
- **Navy:** *Design Manual 5.10, Civil Engineering Solid Waste Disposal* – This information is useful to engineers in the selection of base- specific disposal methods.
- **Airforce:** *AFM 91-11, Solid Waste Management* – This manual outlines efficient and economical solid waste procedures in keeping with sound environmental and engineering principals. In the R.S.A., the airforce has also formulated its specific instructions for waste management during deployment.

The U.S.A. D.o.D. policies on waste management have taken cognisance of national and federal laws and emphasis is placed on the education of soldiers in waste management.

3.6 An Overview of the South African Defence Directives/Guidelines

3.6.1 Introduction

In the South African Defence Force, there are no detailed directives or guidelines dedicated specifically to waste management, but various documents make reference to the handling of waste. This section begins with a review of these documents and, thereafter, the policy regarding medical hazardous waste will be discussed. Lastly, a guideline document produced by the South African Airforce is considered. The investigation is relevant as it reveals that waste management in the S.A.N.D.F. is fragmented and uncoordinated. Thus, the development of an integrated waste management system for the S.A.N.D.F. is crucial in order to facilitate a responsible and sustainable solution to the problem.

3.6.2 Waste Management Directives/Guidelines

General waste disposal is covered by the *CSANDF Draft Directive 7/3 (1999): Health Services in the SANDF*. This directive makes provision for a basic waste management system and focuses on waste storage. It requires that all refuse must be disposed of in bins, lined with plastic bags that are covered with lids. Refuse bins must be stored in suitable refuse storage rooms that are fly and rodent proof. Refuse removal contractors and pig food contractors must adhere to the specifications of the local authority concerned.

The directive also prohibits littering and requires that the person in command of the soldiers must ensure that they do not leave refuse in any military area, open site, stream or dam. This regulation does not, however, provide any instructions for the disposal of waste in rural areas where no municipal services are available. *The Guidelines for the Construction of a Military Refuse Dump*, dated September 1998, requires that site selection of military refuse dumps must include geological and topographical studies and that the pollution of ground and surface water must be

avoided by employing sound engineering skills. Currently there are no licensed waste sites in the Defence Force and open dumping of waste is prevalent in some areas. (Liebenberg, pers. comm., 2003)

During basic training and re-training, soldiers are educated on hygiene and sanitation while in the field. According to the *Infantry School Manual on Hygiene and Sanitation* (undated), the method of sanitation under such circumstances could be direct disposal into the ground (trench/go-kart method), or by removal using a bucket latrine or alternatively, waste could be burnt. The trench/go-kart method will be discussed in greater detail as this is the method used in the research area. The dimensions according to which the trench is dug depends on the period of deployment. A deep trench i.e. one that is 2.4 m deep and 0.6 m long, is normally required for periods of deployment longer than three days. A raised plastic seat with a lid is placed on top of the trench, which is then screened off. According to the *Infantry School Manual on Hygiene and Sanitation*, the disposal of solid waste in the field can be either by incineration or by burning. Waste disposal for deployments lasting longer than six days, should be by means of incineration. The type of incinerator could be either portable or permanent. As deployments in the research area are for a period of two months i.e. longer than six days, the disposal of solid waste should, according to the manual, be done by means of incineration and *not* by the *dig, burn and bury*-method currently in use.

The office of the Surgeon General issued *Handling and Disposal of Waste Materials within and from Health Care Facilities* in September 1993. The aim of this document is to establish uniform procedures for the segregation, collection, movement, and storage and on site disposal of waste materials within military health care facilities. The procedures laid down in this document adhere to the S.A.B.S. Code 0028.

Airforce Mobile Deployment Wing (AFDMW) Instruction. This instruction provides guidelines relating to safety, health, the environment and other factors that should be considered for the SA Airforce. It was compiled by the A.F.D.M.W. in November 2000 and was distributed to airforce units. The aim of this document is to improve on existing systems and processes employed during training and operational deployments, or when forces are prepared for mobilisation. Chapter 4 and 5 include

aspects of sewerage disposal, waste management and pollution control in the field all of which are relevant to this study.

- ***Sewerage treatment and disposal.*** The length and the extent of the deployment will determine the facilities required. Temporary bases will make use of removable containers, e.g. Porta potties, mobile ablutions, suctions and other transferable equipment.
- ***Waste management.*** Informal dumping and the burying of all types of waste is prohibited.
- ***Pollution control.*** Any incidents of soil and water pollution must be reported.

The A.F.D.M.W. instruction is a comprehensive guide for deployments as it considers human health and safety as well as environmental protection. The other service branches should be encouraged to consult this manual in order to develop similar guidelines for their deployments.

It is important for the R.S.A. D.o.D. to note that the formation of a Integrated Waste Management System for Defence must be followed by members being educated on a ongoing basis. As indicated in section 3.5, the U.S.A. D.o.D. places an emphasis on the education of its members and makes use of a base newsletter to communicate updated information on waste management. Waste management in the R.S.A. D.o.D., however, is fragmented and uncoordinated. A waste management strategy for the uniform, effective and efficient management of waste for all of its arms of service is necessary.

3.7 An overview of Relevant R.S.A. Legislation

3.7.1 Introduction

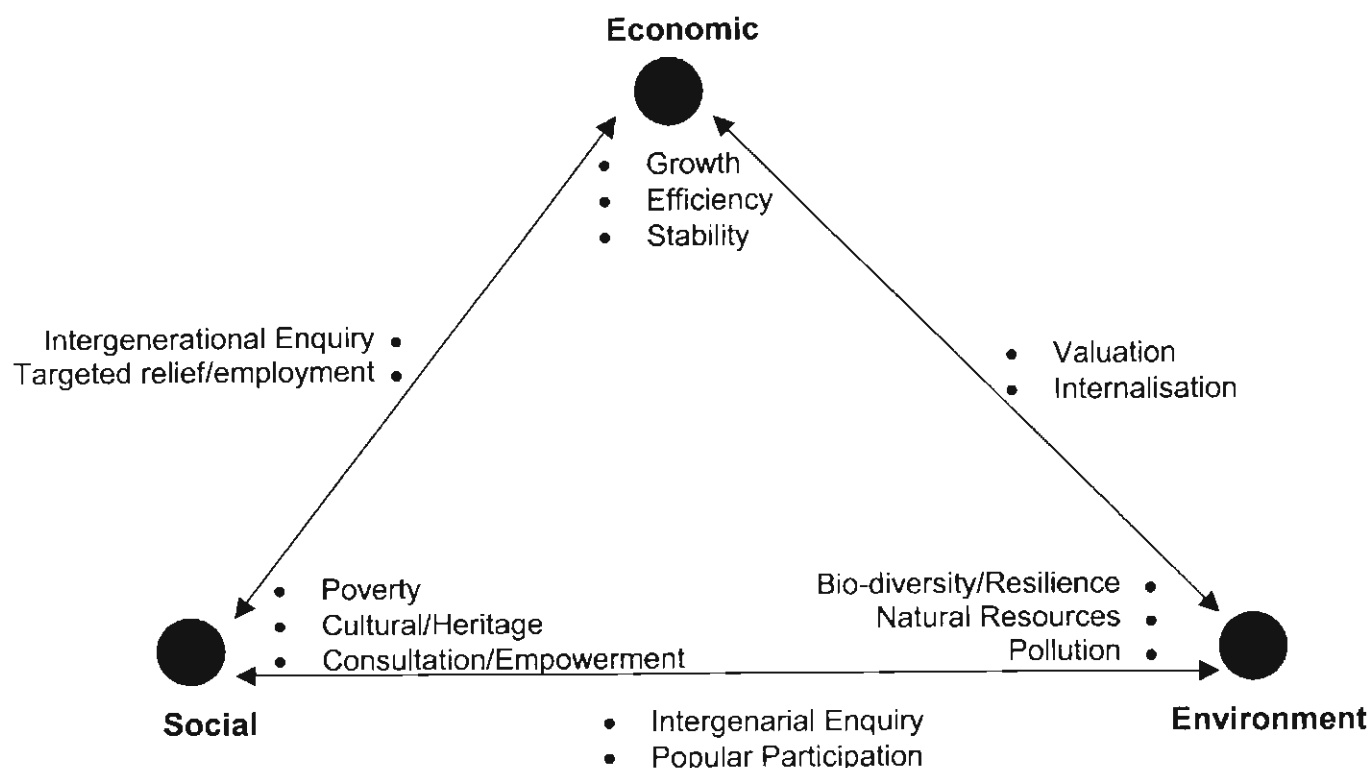
This section reveals the Government's commitment to dealing with the waste management and sanitation challenges it faces. Accordingly, this section reviews pertinent national, provincial and local policies and legislation, which outlines the requirements of the law with regard to waste management and sanitation and

discusses the roles and responsibilities of the various spheres of government in this matter. The policies and legislation emphasize sustainable development. It is therefore necessary at the outset to define the term sustainable development and to explain its role in policies and legislation.

3.7.2 Sustainable Development

The following definition of sustainable development is provided by the World Commission on Environment and Development's document *Our Common Future* (1987). It is described as: "... development that meets the needs for the present without compromising the ability of future generations to meet their own needs" (Markandya *et al.* 2002:17). According to Figure 3.3., sustainable development comprises of three dimensions, i.e. economic, social and environmental. These dimensions are interactive and must therefore be implemented uniformly.

According to O'Riordan *et al.* (2000), the policy development of the previous regime was dominated by Whites, was unjust to the poor and disadvantaged and was aimed at maintaining inequality and the powerlessness of the masses. The 1994 democratic election was a catalyst for fundamental changes in South Africa's institutional framework and legislative policy (Wynberg, 2002). It is therefore uplifting to see that the democratically elected Government has developed policies that embrace sustainable development and thus takes cognisance of human dignity and equity and make provision for the empowerment of disadvantaged communities. Thus the incorporation of sustainable development into new policies and legislation seeks to undo the wrongs of the pre-1994 policies and legislation by recognising the basic human needs of all South Africans.



Source: Modified from Markandya et al. (2002)

Figure 3.3 Three dimensions of Sustainable Development

3.7.3 National Legislation and Policies

The Constitution of the R.S.A. (Act No 108 of 1996) takes cognisance of environmental protection in the Bill of Rights. It also places an obligation on the Government to prevent pollution and environmental degradation as well as to secure sustainable development and the wise use of natural resources through legislative and other measures. [Section 24(a)] Furthermore, chapter two of the constitution makes the following clear:

- (i) All organs of state (including the D.o.D.) are bound by this right and must give effect to it.
- (ii) In order to give effect to this right, the state must establish an effective regulatory framework.

Thus poor waste management practices that can lead to pollution, environmental degradation and negative health effects are unacceptable and the development of an effective waste management system is enforceable by law. The Constitution also provides a legal basis for the allocation of powers to the various spheres of government, which provides the framework for environmental governance. [Section 24(6)] Thus, the democratically elected government of 1994 has taken significant steps to give effect to environmental rights by enacting new laws to protect the environment.

The White Paper on an Environmental Policy for South Africa, 1998, was formulated as a result of an extensive public participation process, i.e. the Consultative National Environmental Process (C.O.N.N.E.P.). The White Paper calls for sustainable development to be incorporated into environmental policy as laid down by the constitution. According to Erasmus and Van Jaarsveld (2002:3), sustainable development has received little more than lip service from government. They maintain: "It is unfortunate that reservations exist about the most appropriate trade-offs between pursuing environmental protection, social welfare and appropriate economic development, and that perceptions persist of environmental quality as a luxury that a developing society cannot afford".

Nyandu (1998), on commenting on the White Paper, also expresses negative sentiments on the integration of the environment in development and ascribes this to D.E.A.T. (which is the main agent responsible for the co-ordination of development across all government agencies) not having enough political power, leadership or budget, resulting in environmental degradation. However, Erasmus and Van Jaarsveld (2002) maintain that the effective use of C.O.N.N.E.P. by D.E.A.T. will prove to be an effective political tool in promoting environmental protection. Chapter 3 of the White Paper contains basic environmental management principles. The "polluter pays", precautionary approach and the "cradle to grave" principles are of importance to this study. These principles are mirrored in N.E.M.A. The White Paper in effect lays down the foundation for N.E.M.A., which serves as a framework for the environmental law reform process of the D.E.A.T and gives substance to the constitutional rights described above. N.E.M.A. is an administrative act that creates rights and establishes duties and obligations. Three fields of environmental concern are addressed by N.E.M.A., namely resource conservation and exploitation, pollution control and waste

management and land use planning and development. These issues, as well as the 18 principles contained in Chapter One of N.E.M.A., serve as a firm foundation for sound and effective environmental management in South Africa (Glazewski, 2000).

The pollution and waste related principles are the precautionary principle, the "polluter pays" principle and the preventative principle. N.E.M.A. provides for sustainable development and requires the consideration of all factors including: " (ii) that pollution and degradation of the environment are avoided or, where they cannot be altogether avoided, are minimised and remedied...(iv) that waste is avoided...minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner...(vii) that a risk averse and cautious approach is applied...and (viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised. It also states that... (p) the cost of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment." [Section 2(4) (a) (ii) (iv) (vii) (viii) page 12]. Sections 3.2 and 3.3 of N.E.M.A. make provision for any person who is concerned about the protection of the environment, and urges that individual to make an application to court to enforce his/her environmental right. However, in a private prosecution the burden of proof "beyond a reasonable doubt" rests on the citizen. This is a heavy burden, especially when obtaining evidence is difficult and when private citizens do not understand the technical procedures involved, which often results in unsuccessful prosecution (Armstrong, 2002).

Section 19 of The National Water Act (N.W.A.) 36 of 1998, makes a provision similar to Section 28 of N.E.M.A. which deals with preventing and remedying the effect of pollution. N.W.A. goes further and sets water use charges, which also provides a charge to discharge effluent into water (Section 56). Thus, the N.W.A. establishes concrete measures for the protection of water which, as already mentioned, is a scarce resource. The overall objective of the Environmental Conservation Act 73 of 1989 (E.C.A.) is to protect the environment by means of controlled utilisation. Sections 19 and 20 of this Act deal with waste management. Section 19 strictly prohibits littering and deems it an offence. This section also calls for a person or authority to provide suitable containers for the discarding of litter by the public. Section 20 stipulates that

application be made to D.W.A.F. for a permit to operate or establish a waste disposal site. In 1998, D.W.A.F. produced a series of three documents outlining (a) the minimum requirements for handling, classification and disposal of hazardous waste, (b) the minimum requirements for waste disposal by landfill, and (c) the minimum requirements at waste management facilities. The purpose of these documents is to facilitate the enforcement of landfill permitting. The control over the permitting of waste disposal sites by national government is currently a thorn in the side of the local government as Section 3.1 of the Constitution states that refuse removal, refuse dumps and solid waste disposal is a function of local government (Ngcamu, 2002).

The White Paper on Integrated Pollution and Waste Management (I.P.W.M.) (D.E.A.T., 2000), provides for holistic and integrated waste management. It is aimed at pollution prevention and minimisation at source, managing the impact of pollution and waste on the receiving environment and remediating damaged environments. The I.P.W.M. policy identifies seven strategic goals namely: effective institutional framework, waste minimisation, impact management and remediation, holistic and integrated planning, participation and partnership in integrated pollution and waste management governance, empowerment and environmental education, information management and international co-operation. These goals are interdependent and must therefore be implemented uniformly.

The vision of the White Paper is that all South Africans should be active in waste management and pollution control. Thus, the White Paper also applies to all Government Departments (including the D.o.D.) and all activities (including Operations) that impact on waste management and pollution. The White Paper is a government declaration and in order to give effect to this statement, the National Waste Management Strategy (N.W.S.) of 1999 was developed, for the purpose of reducing generation of waste and its impact on the environment. The edict also makes provision for the extension of waste management services to all South Africans, which is especially important to black people in rural areas, who have previously had no waste removal services. The key elements of the N.W.S. relate to: integrated waste management planning, waste information systems, general waste collection, waste minimisation and recycling, waste treatment and disposal, capacity building, education, awareness and communication.

According to the Water Supply and Sanitation Policy White Paper of 1994, the goal of central government is to manage the nation's water resources by establishing national policy guidelines, by devising a national water and sanitation development strategy, by formulating criteria for state subsidies and by demanding adherence to the supply of minimum services. This policy ensures that all citizens have access to adequate water and sanitation services. Although local government is responsible for the implementation and the management of sanitation services, the establishment of water boards will act as a link between central and local government in order to provide bulk services. Finally, the Water Services Act of 1997 refers to the establishment of a Water Service Authority (W.S.A.) whose responsibility it is to ensure the provision of water services by local government.

3.7.4 Provincial and Local Policies and Guidelines

D.W.A.F. issued Draft Model Bylaws in August 2000 to local government offices, which are to be used to formulate bylaws in terms of Section 21 (1) of the Water Service Act. These bylaws are meant to assist local government in the provision of effective and efficient water services.

The KwaZulu-Natal Policy on Waste Management of August 2003, was formulated in response to Chapter 2 section (ii) of N.E.M.A.(R.S.A.1998), which requires scheduled organs of state, and every province, to prepare Environmental Management Plans (E.M.P.'s) of which waste management is an integral part. The overarching goal of this policy is to establish an equitable, just, integrated and holistic system of waste management involving all stake holders in waste education, minimisation, reduction, recycling, elimination where possible and safe disposal of unavoidable waste.

One of the objectives of the policy that is of relevance to this research is the intention of establishing waste management practices in rural areas appropriate to the community, which would involve the provision of adequate facilities, without lowering standards in any way.

In March 2003, the KwaZulu-Natal Department of Agriculture and Environmental Affairs (D.A.E.A.), in accordance with the I.W.M.P., issued guidelines on Integrated Waste Management Plans for Local Government to its Metro Municipality and the ten district

municipalities. The purpose of these guidelines is to build capacity and to guide municipalities in the development of their plans, which must be submitted to D.A.E.A. by December 2004.

As already mentioned, the policies and legislation reviewed embrace sustainable development and are intended to undo the injustices of the past. However, Fitzgerald *et al.* (1999) argues that these policies are over optimistic and those responsible for implementing them have not been able to keep to set targets. Many factors contribute to the lack of service delivery by Government. According to O'Riordon *et al.* (2000) the placement of the poor and disadvantaged in jobs, with no in-post training, results in a lack of institutional capability. O'Riordon *et al.* (2000) goes on to state that this situation is further aggravated by shortfalls in budget and experienced staff. Lombard and Lombard (1996) also cite tension and conflict between government departments to be a contributing factor, as these disputes hinder service delivery, which results in the poor and disadvantaged being further marginalised and leads to ineffectual protection of the environment.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

The purpose of this chapter is to discuss in detail the research methods utilised in this dissertation.

The basis of this research was the collection of data in the field. It was decided that the most appropriate method for such a study would be the intensive qualitative method. There is no fixed format to be followed in a qualitative research report (Strydom, *et al.* 2002). According to Rubin and Babbie (1993), field research comprises of various methods i.e. direct observation, participant observation and unstructured or intensive interviewing. The use of direct observation enables the researcher to physically see and learn, thus enhancing his/her understanding of the research subject. Monette *et al.* (1998), states that observation is a technique that allows the researcher to gain information that might otherwise be missed. The collection of primary data was by means of observations, interviews and questionnaires.

The discussion which follows, firstly, provides an overview of the different research techniques, secondly the advantages of the qualitative method are discussed, thirdly the research techniques selected in this research are explained and, lastly, a description of the methods used to interpret the information collected in this study is provided. Finally, the method in which research is conducted in the S.A.N.D.F. is outlined.

4.2 Data Sources

Primary and secondary data sources were utilised to achieve the objectives of this dissertation.

4.2.1 Primary Data Sources

The collection of primary data can take many forms. The word data does not refer exclusively to numerical data. All the verbal and numerical verbal data for this study

were collected personally by the researcher from the research area and from other relevant role players

The collection of the primary data took the form of observations of the waste management practices, and included interviews with senior members of the S.A.N.D.F. in the research area. Moreover, interviews with relevant members of government (provincial and local) were conducted and the deployed soldiers in the research area were asked to complete questionnaires. An audit was taken of the solid waste generated from the ration packs.

4.2.2 Secondary Data Sources

A secondary data source is information that has been collected by other writers which is available to be reviewed by fellow researchers (Flowerdew and Martin, 1997). The secondary data collected for this study were sourced from national and international government departments, S.A.N.D.F. policies and health reports and consultants' reports on waste management, records of operational meetings in the research area and textbooks, journal articles and internet sites on waste management.

4.3 Quantitative Research Methodology

According to Monette *et al.* (1998), the use of quantitative research methodology enables the researcher to remain objective and to reach an understanding of the facts by an analysis of the data which can be in the form of numbers, counts and the measurement of objects. Rubin and Babbie (1993) mention in their study that the quantitative method is appropriate in research where the researcher has an in-depth knowledge of the topic and very good control of the research situation. The quantitative method is highly structured and designed to provide precise information on the research topic (Monette *et al.*, 1998).

4.4 Qualitative Research Methodology

The use of qualitative research methodology enables the researcher to obtain a rich holistic understanding of the research study from the data that is available in the form of words, pictures, quotes and descriptions (Monette *et al.*, 1998). According to

Strydom *et al.* (1998), the qualitative method is less structured and the design is more flexible. Qualitative reports are generally longer and more descriptive compared with quantitative reports. In this research, the qualitative research method was employed to describe the experiences and the views of the soldiers on current waste management and sanitation practices in the S.A.N.D.F. Key information was obtained from senior members of the S.A.N.D.F. and from members of provincial and local government.

4.5 Research in the S.A.N.D.F.

Research conducted in the S.A.N.D.F. is governed by the South African Defence Force Order, *The Maintenance of Security in the SANDF*, dated February 1997. In accordance with this order, names of S.A.N.D.F. personnel may not be revealed and the names of military installations may not be made known. This dissertation will therefore refer to military personnel by means of their appointment or rank and to military installations according to the place where it is situated, e.g. "base in Jozini" or "Eshowe Headquarters". Authorisation for research projects must be made in writing to the Intelligence Division Headquarters in Pretoria. The request must contain specifications of the research area as well as details of the person who will be conducting the programme. Copies of interview schedules and questionnaires must also be cleared before they may be used. Research may only commence once authority has been granted. On completion, a copy of the final draft must be sent to Defence Intelligence for final clearance, before it is sent to external authorities. A full copy of the final dissertation must be submitted to Chief Logistic for possible implementation and for reference purposes to other researchers.

4.6 Case Studies

Case studies are generally qualitative tools and according to Creswell (1998), as cited in (Strydom *et al.*, 1998), they are regarded as an in-depth analysis of a place or time. Robert Yin (1985), as cited in (Rubin and Babbie, 1993:23), defines a case study as an analysis that "investigates a current event in a real life situation". He mentions that "the boundaries between the cause and the context are not clearly evident" and explains that "this necessitates the use of multiple sources of evidence".

The requirements for an intensive case study method used for this dissertation were met as data were collected by means of documentation, observations and interviews (Rubin and Babbie, 1993). According to Strydom *et al.* (1998) it is important that the researcher has an in-depth knowledge of the relevant literature.

In this dissertation, the review and understanding of the relevant legislation and its requirements w.r.t. waste management was facilitated by the formulation of questions for both the interviews and questionnaires. This aspect of the study enabled the researcher to make appropriate deductions on the shortcomings of the waste management practices relating to deployments in rural areas and drew attention to the gaps in management and policies of the S.A.N.D.F.

4.7 Data Collection

As already mentioned, primary data for this dissertation were collected by means of:

- Structured interviews containing open and closed questions and took the form of questionnaires administered by the researcher
- Semi-structured interviews
- Participant observation

Secondary data were collected by means of a review of:

- International trends in waste management
- International U.S.A. D.o.D. waste management legislation
- National waste management legislation
- Consultants' reports
- S.A.N.D.F. policies and operational meetings
- D.W.A.F. case studies on waste management
- Journal articles

- Internet sources

4.7.1 Data Collection using Qualitative Research Tools

4.7.1.1 Interviewing

Interviewing is one of the most common means of data collection (Reamer, 1998). It involves face to face communication where the researcher obtains information from the respondent. In this instance, three groups of respondents were used. This approach was preferred above the telephonic or the self-administered survey method, as the one-on-one interview technique allows for probing or follow-up questions (Monette *et al.*, 1998), thereby enabling the researcher to obtain clarity, or additional and more specific information.

All respondents were briefed on the purpose of the research and what it hoped to achieve prior to the interview. This helped to create a rapport between the researcher and those being interviewed, so that they had a clearer understanding of the research topic and in this way the data collection process was facilitated (Rubin and Babbie, 1993).

The researcher made extensive use of the tips on interviewing and communication techniques found in Strydom *et al.* (1998: 293-299). These were found to be useful in the formulation of questions and in preparing for the interviews. There are various methods of one-on-one interviewing (Strydom *et al.*, 1998) and the choice of what the researcher considered to be the most appropriate method and the reasons for that choice become clear in the explanation which follows:

- **Structured Interviews** requires that all respondents be asked the same questions in a set sequence (Rubin and Babbie, 1993). In this dissertation, this method was employed in interviewing deployed soldiers at the temporary bases. Both open and closed questions were included in the interview schedule, to allow for a degree of flexibility. In order to ensure that the data collected are correct and sufficiently detailed, the formation of the questions is important (Robinson, 1998). The use of simple language and short questions helps to reduce

confusion. The questions posed to the respondents allowed the researcher to obtain information about their own knowledge and their opinions on waste management. The questionnaire revealed what education, if any, is provided by the S.A.N.D.F. on this topic, and elicited information on practical experiences and problems encountered with waste management by those deployed in rural areas. Each interview lasted for approximately 10-15 minutes. The answers to the questions were recorded on a form. Thirty respondents were interviewed, with the location and relevant rank groups reflected in Appendix E.

- **Participant Observation** This is a method of data collection that gets the researcher closer to and more intimately familiar with the respondents and their situation (Rubin and Babbie, 1993). In this dissertation, participant observation was utilised to verify and supplement information provided by the members of the S.A.N.D.F. in the interviews. It proved to be a time-consuming exercise, which involved viewing, listening, and recording of data and also included a waste audit. The waste audit entailed obtaining data on the content and weight of the solid waste generated from ration packs in the temporary bases. As advised by Robinson (1998), the researcher has to exercise caution when asking questions of a sensitive nature, i.e. questions on how/where they relieved themselves, in order to prevent an invasion of privacy.
- **Semi-Structured Interviews** A set of pre-determined questions was drawn up. These questions served to guide the discussion and not to dictate the interview pattern (Strydom, *et al.*, 1998). This method of data collection was employed to obtain input from various government officials and Non-Government Organisations which are specialists in the field of waste management. These respondents were able to provide useful policies and guideline documents w.r.t. waste management and the information was utilised in Chapter 3. These interviews lasted for approximately two hours. Open-ended questions allowed for the flexibility necessary for the respondents to share their specialist

knowledge and also to instruct the researcher on aspects of the research topic.

4.7.2 Data Analysis and Interpretation

According to Strydom *et al.* (1998), data analysis is a process that involves creating order, structure and meaning in relation to the information collected. The researcher reads widely on the topic under investigation, then summarises and looks for patterns and similarities in the assimilated material. According to Reid and Smith (1981), cited in Strydom *et al.* (1998), the analytical process is guided by the purpose of the study. In this dissertation, the analytical deductions formulated by Robinson (1998) have been consulted. The information on waste management elicited from the literature review provided the context within which the data obtained could be assessed in order to identify the shortcomings of the waste management practices in the research area. Recommendations and conclusions followed.

One of the limitations of participant observation is that the respondents do not act normally in the presence of a spectator, but in this case, the respondents did not feel that they had to hide anything as they genuinely thought that they were doing the best they could under the circumstances. Answers to questions were provided freely as there was no fear of any negative reactions from senior officers.

Field observation proved to be a useful method of data collection as questions were altered or added as the need arose and as significant issues were identified in the field (Strydom *et al.*, 1998). Being present on site also enabled the researcher to observe the waste management practices of the local community.

The researcher's current position in the S.A.N.D.F., i.e. as S.O1 Regional Environmental Management, and her prior position in the S.A.N.D.F. as S.O2 Environmental Health (for seven years) in K.Z.N., was a definite advantage in assimilating data. Her knowledge of and familiarity with the research area and the S.A.N.D.F. allowed admission to information that a civilian would not have been able to access. The researcher is therefore confident that the data is valid and of a high quality, as it was gathered personally.

CHAPTER FIVE

DATA PRESENTATION AND INTERPRETATION

5.1 Introduction

The broad aim of this research is to determine the legal compliance levels of the current waste management practices of the S.A.N.D.F.'s deployments in the rural areas of Northern KwaZulu-Natal. The purpose of this chapter is therefore to investigate whether waste management and sanitation are integrated into operational planning, to observe the waste management practices of the deployed soldiers and to determine the instructions or direction provided to the soldiers with regard to waste disposal. This chapter is structured into three parts.

In the first section, the information obtained from senior members of the S.A.N.D.F. is organised into two categories, one of which examines the role of tribal authorities while the other deals with the integration of waste management in operational planning.

Thereafter, data collected from the soldiers on the current waste management practices and available sanitation during deployments is presented. The information obtained is organised into four themes. The first theme reveals the type and composition of the waste generated. The second theme investigates instructions/directions provided to the soldiers on waste management and the third theme relates to the present waste management practices at the temporary base (T.B.) during deployments and patrols. The fourth theme focuses on sanitation. The opinions of the soldiers with regard to the sanitation provided at the T.B. and during patrols are noted. In the third section of the chapter, information obtained from key informants is presented.

5.2 Interviews with Senior Members Involved in the Planning of Operations

5.2.1 Introduction

The Operations Planning Officer (S.O1 Ops) from Group Headquarters (Eshowe), and the Company Commander of the deployed company from Potchefstroom (home unit),

were interviewed. The responses obtained from these respondents to questions asked as denoted in Appendix A and Appendix B, respectively, are presented in the section that follows. These members are involved in the planning of operations, which takes place over a two-month period prior to the deployment.

As already mentioned, the information obtained from these members is organised into two themes. The first discusses the liaison between the S.A.N.D.F. and the owners of the land used by the S.A.N.D.F. for deployment. This information provides insight into how the deployments and the associated activities of the S.A.N.D.F. are viewed by the tribal authority concerned. The second issue deals with the processes involved in operational planning and takes into account the factors that influence operations. These investigations reveal the degree to which waste management and sanitation are integrated into operational planning.

5.2.2 External Liaison

The land on which the S.A.N.D.F. deploys soldiers belongs to the tribal authority. Prior to the deployments, the chiefs are visited. The purpose of this visit is to inform the chief of the presence of the S.A.N.D.F. on tribal land. Authority to deploy on tribal land is not necessarily requested and no conditions are laid down by the chief for the use of the land. The Company Commander, S.O1 Borderline Control (S.O1 B.L.C.) and the Communications Officer are responsible for the liaison with the chief prior to and during deployments. The chief does not visit the deployed soldiers and there is no handing and taking over procedure prior to the deployment or on withdrawal from the area.

The above indicates that the tribal authority does not monitor the activities of the S.A.N.D.F. during deployment. On being asked whether it is necessary for the S.A.N.D.F. to request authority from the chief, for the use of their territory, the S.O1 Ops stated that the chief and his people are happy to have the S.A.N.D.F. on their land. The presence of the S.A.N.D.F. serves as a crime deterrent and thus creates a safe living environment. The basic need for safety and security takes precedence over any potential environmental damage that could result from the use of the land by the S.A.N.D.F. It was noted in section 1.9 that 60% of the population earns less than R1,500 per month, which means that a significant portion of the community live in deep poverty and thus their need for food and shelter will definitely be more important than

environmental safety. Furthermore, in section 3.2.3, Hannien and Rautanen (2002) noted that such communities lack the knowledge necessary to link predisposing environmental factors to illness.

5.2.3 Integration of Waste Management in Operational Planning

S.A.N.D.F. operations are executed in three phases. The S.O1 Ops was asked to describe briefly the planning and processes involved:

Phase One: Planning and Preparation for the Deployment. The planning for an operation takes place over a period of two months. The discussion that follows lists and explains the preliminary activities. The re-training of soldiers is conducted over a one-month period at the home unit. Aspects that are covered in re-training are dependant, firstly, on the nature of the forthcoming operation and, secondly, on the aspects that require attention as reflected in the debrief report (a report that is written at the end of each military exercise, which contains information on the problems experienced during the deployment). Therefore waste management and sanitation will only be covered if these aspects are reported in the debriefing report as being a problem. Pre-deployment evaluations of the company are conducted by the S.O1 Ops from the Group Headquarters at the home unit. The purpose of this evaluation is to determine the combat readiness of the soldiers and to inspect their equipment. A pre-deployment meeting is held at the Operational Headquarters (O.H.) in Durban. This meeting takes place one month prior to the deployment and is attended by the Company Commander and the advance team. The purpose of this meeting is for the O.H. to issue the mobilisation instruction to the company and support structures to be combat ready.

The Company Commander and the advance team conduct reconnaissance, planning and preparation for the operation, one month prior to the deployment. During the preliminary procedures, the Company Commander gathers intelligence information on borderline control, i.e. threat aspects, such as illegal immigrants, firearms, drugs, stolen vehicles, etc. Climatic conditions of the deployment area (temperature, humidity) and the veld-type are also noted and all this information is written up in an operational instruction agenda. According to the respondents, the intelligence information that is obtained prior to the deployment will dictate the area of deployment. Environmental

conditions such as climate and veld-type are given secondary consideration. The logistical preparation for the operation takes place at the Group H.Q.

Phase Two: The deployment and execution of borderline control operations.

During this phase, the soldiers are moved from their home unit to the base in Jozini. An important aspect of this phase is the induction programme (Table 5.1). During the induction, the soldiers are welcomed by the Officer Commanding of the Group H.Q. and are then addressed by the various members. It is worth noting that the induction programme sometimes includes a presentation on endangered species by Ezemvelo K.Z.N. Wildlife. Soldiers are sensitised on products (Cycads and animal products) that may not cross the border. They will confiscate these products and hand them over to Ezemvelo K.Z.N. Wildlife.

Aspects such as personal hygiene, base hygiene (littering) and discipline are included in the presentation of the Group Sergeant Major (G.S.M.). The Medical Liaison Officer (M.L.O.) sometimes covers aspects of hygiene and waste management. After the induction programme, soldiers are moved to the deployment area for the execution of the operation. During phase two, there are weekly meetings at the base in Jozini. These meetings of the liaison operational committee (L.O.C.) are held between the Company Commander and the S.O1 B.L.C. to discuss operational aspects and problems experienced in the deployed areas.

Phase three: Demobilisation, handing over and taking over and returning to the home unit. Temporary bases are taken down and soldiers are withdrawn from the deployment area. There is a handing over and taking over procedure between the soldiers that are withdrawing and the incoming soldiers. In phase three, the Company Commander writes a debriefing report. This report contains information on the problems experienced during the deployment. A copy of the report goes to the Group H.Q. as well as to Chief Joint Operations in Pretoria. The purpose of the debriefing report is to note problems in order to rectify and to improve on future operations

Serial No	Subject	Presented by	Time
	A	B	C
01	Chaplain opens with scripture reading	Chaplain	0845 – 0900
02	Welcoming by the Officer Commanding	Officer Commanding	0900 – 0930
03	Discipline aspects	GSM	0935 – 1014
04	Intelligence orientation and briefing	SO2 Int	1015 – 1100
05	Operational overview	SO1 Ops	1105 – 1150
06	Operational Legal aspects	Legsato Dbn	1155 – 1245
07	LUNCH		1245 – 1330
08	Military Security	SO2 MS	1330 – 1415
09	Communications	SO3 Com	1420 – 1440
10	LTU and Off Duty Policy	Trg	1445 – 1500
11	Medical aspects (whole coy)	Med LO	1500 – 1530
12	Logistical procedure	SO2 Log	1530 – 1700
13	Facilities and Vehicles	SO2 Fac	
14	Medical aspects (medics)	MLO	
15	Pers and Fin aspects	SO2 Pers	

Source: Operations Planning Officer, Group Headquarters, Eshowe

Table 5.1. Induction Programme

The Company Commander mentioned that aspects of waste management are not covered during the reconnaissance phase. The researcher was allowed to read the Operational Instruction for the deployment (written in phase one) and this directive mentions that refuse bags must be available in vehicles during the movement to the deployment area, as littering from the military vehicles is strictly prohibited. However, the management of waste at the T.B. and during patrols is not covered in the Operational Instruction document. The respondents were in agreement that the current waste management problems are the lack of black bin bags and the unavailability of a vehicle for the removal of waste from the T.B. to Ndumu. Logistical planning for the operation is core function focused and concentrates on items such as rations, petrol, oil and fuel, etc. No vehicle is provided for refuse removal from the T.B. to the dumpsite at Ndumu. There was, however, a general problem with the supply of vehicles during this deployment.

According to the S.O1 Ops, waste management requirements are determined as the operation goes along. As mentioned in Section 3.2, waste management that focuses on disposal only will lead to the mismanagement of waste. The planning for refuse disposal during operational planning is absent. Aspects such as waste generation, storage and transportation are not taken into account, as is required by a basic waste

management system, as described in Section 3.2 of the literature review. According to the logistic officer of the Group HQ, companies are supplied with bins and bin bags when funds are available. Currently, no funds are budgeted for these items by the operations section. The Group is therefore unable to meet the needs of the company (Logistic Officer, Group HQ, pers. comm., 2003)

The Company Commander mentioned that waste management issues are reported on to the SO1 B.L.C. at the weekly L.O.C. and that thus far no rectification measures have been implemented. He also added that poor waste management practices at the T.B. are addressed by the Company Sergeant Major. Soldiers who disobey orders have their DSTV cards taken away from them (Company Sergeant Major, deployed unit from Potchefstroom, pers. comm., 2004). On being asked if aspects of waste management are covered in the induction programme, the Company Commander said that it was only covered sometimes. The instructions were to burn the paper, cardboard and plastic and to collect the tins and transport these to the dumpsite at Ndumu (Plate 1).

The S.O1 Ops mentioned that the M.L.O. sometimes covers aspects of waste management in the induction of the soldiers. He went on to state that it was a medical responsibility to provide waste management information to the soldiers. This is confirmed in the review of S.A.N.D.F. policies and guidelines in Section 3.6, as guidelines are issued by the office of the Surgeon General.

The S.O1 B.L.C. has no control over the lack of availability of funds for waste management or vehicles for refuse-removal. As stated by the Company Commander, no corrective actions have been taken on waste management issues reported. However, the S.O1 B.L.C. should, at the very least, make these problems visible to the Group in the form of a report. As already mentioned, the debrief report for this deployment did not include waste management, but the vehicle problem was reported, as this resulted in numerous consequences that affected the core function of the operation.



Source: R .Varaden

Plate 1. Dumpsite at Ndumu

The researcher reviewed copies of a number of medical induction programmes that were presented to the soldiers, including that of the current deployment group. Waste management was not mentioned in any of these agendas. The medical instruction focuses on procedures for sick reporting, and one may therefore conclude that the inclusion of waste management in other similar programmes is highly unlikely. Copies of various debriefing reports of deployments in the research area were also reviewed. Some aspects covered in these reports include discipline, intelligence, medical matters, hygiene, rations and living conditions, etc. As already mentioned both respondents confirmed that there were problems with waste management. However, this is not mentioned in any of the debriefing reports consulted as these focus on core function problems and waste management is not perceived to be a problem that will impact on the primary objectives of the operation.

5.3 Current Waste Management Practices during Deployments

5.3.1 Introduction

Thirty respondents were interviewed (*Appendices D and E*). The waste management practices of the soldiers on the ground are dependant on the planning that takes place in phase one. This section discusses the problem of waste disposal as experienced by the respondents and as observed by the researcher.

5.3.2 Types of Waste Generated

All respondents indicated that the majority of the waste generated at the T.B. and during patrols is from ration packs. A ration pack consists of a breakfast, lunch and supper and is meant to sustain a soldier for one day (Plate 2). The average number of soldiers at the T.B. is ten and each person receives one ration pack per day for a deployment period of two months. As the average number of days for this period is sixty days, the number of ration packs issued at the T.B. for the period of deployment is 600 ration packs. The total weight of the paper, cardboard, plastic and tin is reflected in Table 5.2 below. A total of 147 kg of waste is produced over a period of sixty days. The waste generated is depicted in Plate 3 (Plastic, Cardboard and Paper) and in Plate 4 (Tin).

Item	Mass in Grams
Tin	106.91
Cardboard	71.71
Paper	19.39
Plastic	47.17
Total Weight	245.18

Source: R.Varaden

Table 5.2. Mass of waste generated from one ration pack

It must be noted that these figures do not account for the waste emanating from patrols, which might be brought back to the T.B. A very small amount of waste comes from empty toiletry packaging (mainly soap and toothpaste) and items purchased from shops (beer and coke bottles, potato crisps).



Source: R.Varaden

Plate 2. Contents of one ration pack



Source: R.Varaden

Plate 3. Waste created from one rat pack (plastic, cardboard and paper)



Source: R.Varaden

Plate 4. Waste created from one rat pack (tin)

The method of waste disposal used by the community is in the form of open dumping, and sanitation is in the form of pit-latrines. Observation at the T.B. and at the residences of the local population revealed that there was no littering (Plate 5). Refuse was, however, strewn around the residences of the local population. It was interesting to note that, although there are many shebeens in the area, there were no discarded bottles. On questioning the local population, it emerged that a deposit was attached to all bottles, and it would thus appear that deposits provide a good incentive for recycling.



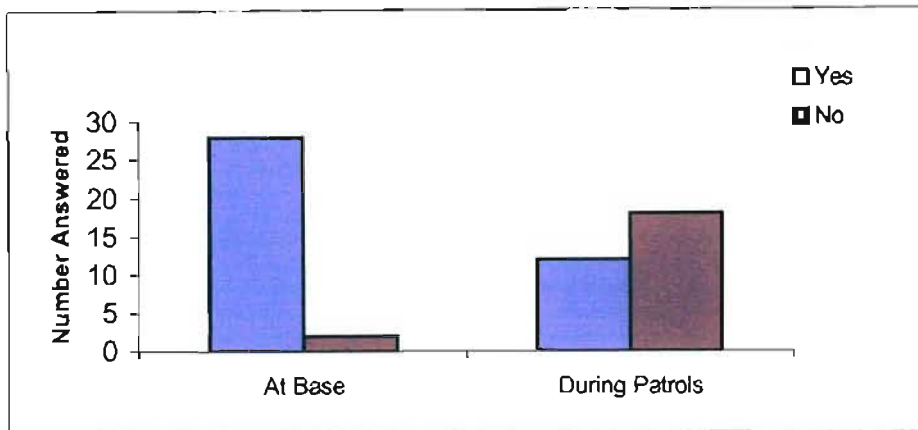
Source: *R.Varaden*

Plate 5. Temporary Base

Ninety-eight percent of all waste generated at the T.B. and during patrols is recyclable. According to Bosman (1998), this waste does not need to be discarded into the environment, as it can be recycled. Bredenkamp and Wates (1998) confirms that a market does exist for the recycling of items generated in the research area.

5.3.3 Waste Management Instructions or Guidelines Provided to Soldiers

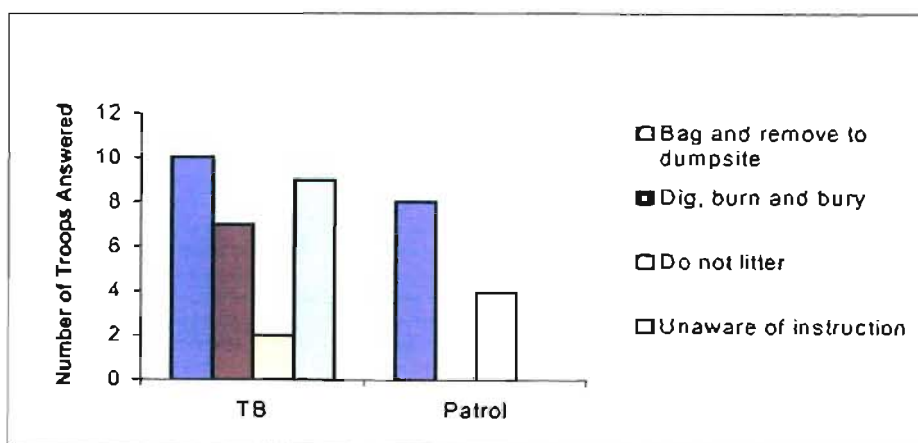
Figure 5.1 indicates the number of soldiers that received and did not receive instructions on how to manage waste at the T.B. and during patrols.



Source: R.Varaden

Figure 5.1: Instructions received by soldiers

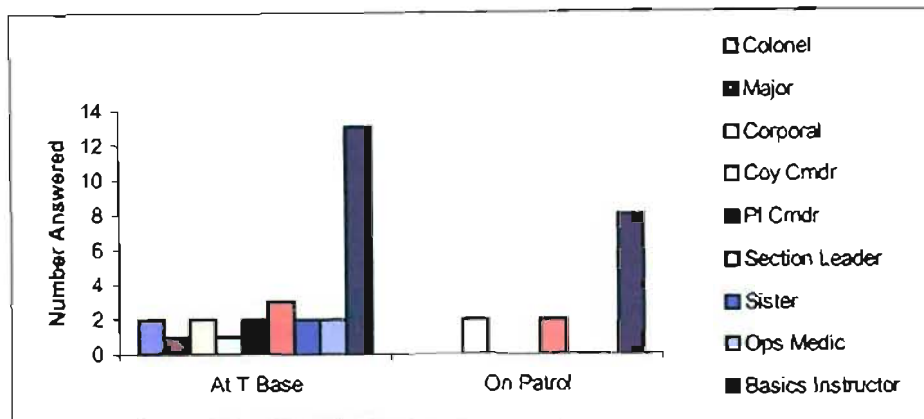
Ninety three percent of the respondents claimed to have received instructions at the T.B., while only 40% received instructions during patrols. On being asked what they were told to do, the responses varied (refer to Figure 5.2 below). Thirty three percent of the respondents at the T.B. and 36% on patrol indicated that they had been ordered to place refuse in plastic bin bags for removal to the dumpsite at Ndumu. Adherence to this directive was not possible as the respondents stated that no plastic bags were available for refuse collection and also that no vehicles are available to remove the refuse from the T.B. to Ndumu.



Source: R.Varaden

Figure 5.2: What Instructions were issued?

Forty three percent of the soldiers claimed to have received waste management instructions during basic training. The literature review confirms that infantry soldiers do receive information on disposal of waste during deployments in areas where no municipal services are provided. Figure 5.3 depicts the varied responses to the question “Who issued the waste management instruction?”

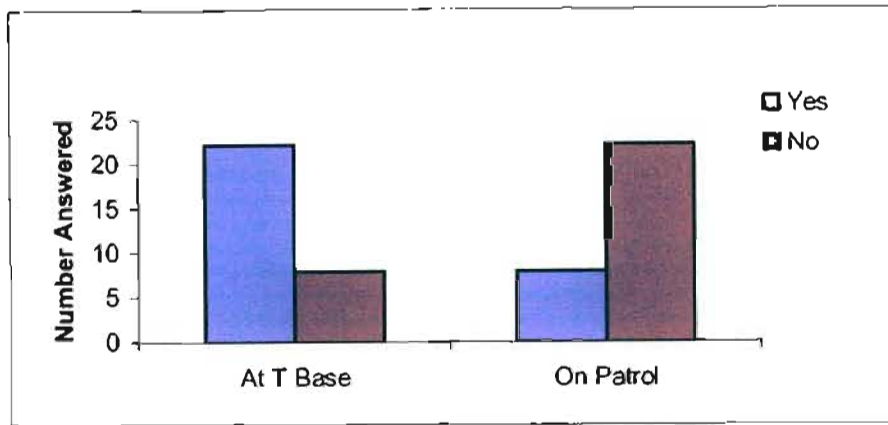


Source: R.Varaden

Figure 5.3: Who issues these instructions?

The validity of the answers provided to this query is, however, questionable. It is unlikely that the Colonel, Major or Sister issued waste management instructions to the soldiers, as the researchers own experience (ten years full-time service) in the S.A.N.D.F. has revealed that senior members of management do not involve themselves with details such as waste management and hygiene. Secondly, the Sister at the Sickbay is mainly concerned with the medical waste generated during deployments. Thirdly, the respondent's interaction with upper management is mainly restricted to the induction period mentioned in Section 5.2.3.

Reviews of the induction programme revealed that waste management is not covered during this exercise except for the odd occasion that it might be mentioned in the medical briefing. All the respondents claimed to adhere to instructions issued. Their response to questions on whether waste management practices are monitored at the T.B. and during patrols is reflected in Figure 5.4.



Source: R.Varaden

Figure 5.4: Soldiers responses regarding waste management practices monitored at the T.B. and during patrols.

Seventy six percent of the soldiers at the T.B. and a mere 20% of those out on patrol indicated that there was control over whether waste management regulations were adhered to. Greater compliance probably occurred at the T.B. because a trench is dug in the ground (Plate 6) for refuse collection and disposal by burning, whereas during patrols no provision is made for refuse storage or removal. Secondly, the presence of the Platoon Commander or Section Leader as well as visits by senior officers from the base in Jozini and the Company H.Q, serve as a deterrent to littering at the T.B., while during patrols the soldiers are on their own with no-one to observe their actions. The monitoring of waste management practices at the T.B. is adequate. However, during patrols monitoring is inadequate.



Source: R.Varaden

Plate 6. A trench is dug in the ground at the T.B.

5.3.4 Current Waste Management Practices

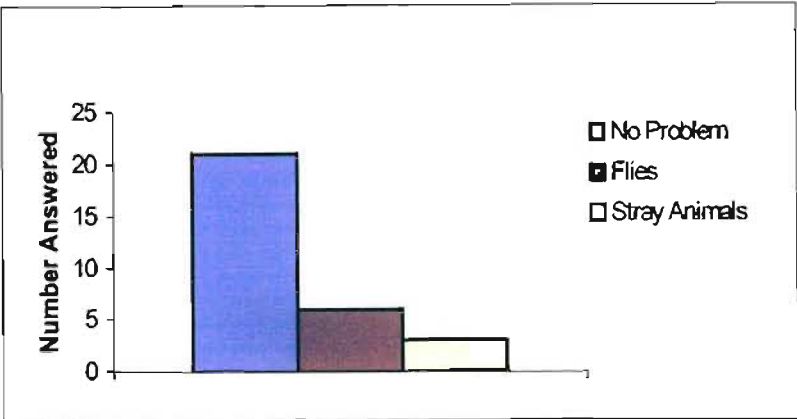
Eighty six percent of the respondents stated that they dig, burn and bury refuse at the T.B. while only 23% said that they were told to manage waste in this manner. The disposal of refuse by the soldiers does not accord with the instructions they claim to have received. This is not necessarily an indication that soldiers disobey orders, as they were not provided with black plastic bin bags to collect refuse nor were they provided with the means to transport the refuse generated at the T.B., to the dumpsite at Ndumu.

All the soldiers indicated that the waste generated during patrols should be brought back to the T.B. for disposal, and 50% complained that they had observed their colleagues dumping litter during patrols. The absence of a supply of bin bags contributes to refuse being left behind in the field.

The current practice is considered illegal, according to Section 20 of the E.C.A. and littering is in contravention of Section 19 which strictly prohibits the dumping of waste. The existing methods of waste disposal are a potential threat to the integrity of groundwater and may result in serious public health problems. Wright (1999) is quoted as drawing attention to the fact that human activities such as on-site sanitation and garbage disposal do have the potential to contaminate groundwater and, as this is the only source of domestic water supply to the local population, the action of the deployed soldiers could have serious consequences.

Figure 5.5 depicts the current problems that the soldiers experience with the management of waste.

Sixty six percent of the soldiers were satisfied with the current waste disposal methods and felt that they were doing the best they could under the circumstances. However, 30% were not satisfied and felt waste should be collected in plastic bags and removed at least once a week to the dumpsite. It is interesting to note that none of the respondents suggested that the existing waste management practices are environmentally unsound or that they could create a health risk to the local population. This is an indication that the soldiers are not environmentally sensitive and furthermore, that they not aware of the health risks associated with poor waste management.



Source: R.Varaden

Figure 5.5: Current waste management problems experienced by soldiers.

5.3.5 Sanitation.

The soldiers are not provided with sanitation services at the T.B. and during patrols. No waste water services are provided by the municipality to this area. The go-kart system is the means of sanitation at the T.B. The go-kart used by the soldiers at KwaMshudu is not properly screened off and, again, the lid is broken (Plate 7). The go-karts at Farezellla are also not screened off and again, the lids are missing, thus providing a place for the breeding of flies and the spread of diseases.



Source: R.Varaden

Plate 7. Go-kart used by the soldiers at KwaMshudu

All respondents indicated that they make use of the shovel method to relieve themselves during patrols. They dig a small hole in the ground with a spade, which they then cover. Sixty percent of the soldiers stated that they were satisfied with this method while 40% were dissatisfied. The soldiers that were dissatisfied were asked their opinion on how the current situation could be improve. Four respondents who disapproved of the flies said that chemicals must be made available to deal with the problem.

One soldier said that the go-kart should have a lid, while four others stated that they were not satisfied with the sanitation available, but that they did not know what could be done to improve on the situation. It was also mentioned that the shovel-method sometimes resulted in soldiers digging up another person's waste.

5.4 Information from Key Informants

5.4.1 Introduction

This section contains the current information on planning and projects on waste management and sanitation. The information was obtained by direct liaison with members of D.W.A.F., D.E.A.T. and officials of the Umhlabuyalingana Municipal District. These representatives are directly involved in the planning, decision-making and implementation of projects in the study area. The Environmental Health Officer (EHO) of the S.A.N.D.F., responsible for the research area, was also interviewed and key information was obtained from him on the management of solid waste and sanitation.

5.4.2 S.A.N.D.F. Health Inspections in the Study Area

The Officer has been the Environmental Health Officer (EHO) of the research area for one year. During this period, he has visited the region once, as obtaining a 4x4 vehicle, which is required to access the area, is very difficult. He is of the opinion that the solid waste generated by the soldiers should be bagged and brought to Ndumu, where after it must be transported to Jozini for disposal. Even though Jozini does not have a registered landfill site, this would be preferable to the current *ad hoc* management of

waste. Mobile toilets should be used for human waste or, if this is not feasible, other methods should be sought.

The regional Environmental Health department views the current methods of waste disposal as unacceptable and thus has been communicating to the person in charge of the deployment as well as the Ops Medic, although raising issues with the Ops Medic is not always productive, as the Company Commander often does not pay much attention to the members of the medical staff. Once the E.H.O. returns to the office, a health report is written and sent to the Group HQ. According to the Officer, very little is done by the Group once they receive the report. He went on to say that: "An E.H.O. is like a watchdog without teeth". He is of the opinion that management must get involved before soldiers will change their behaviour. He also stated that where the responsibility for waste management ultimately lies is, at present, ambiguous and that this matter should be clarified if the situation is to improve.

Health inspections in the deployed area are inadequate. Follow-up inspections are necessary to review matters reported on and this is not taking place. Copies of the inspection report must be sent to the environmental section in Ladysmith as well as to the regional environmental office in Durban. The environmental managers responsible must take note of the solid waste problems and address the areas of concern. The E.H.O. is a member of a professional team of the Medical Headquarters and his recommendations for rectifying the waste management issues in the research area should be heeded.

5.4.3 Comments and Recommendations by D.W.A.F.

Deputy Director Water Quality Management of D.W.A.F., Mr Charlie Joubert, is of the opinion that the S.A.N.D.F. should firstly develop a waste management policy. Secondly, to improve on the current waste management practices at the T.B., combustible waste (i.e. plastic, paper and cardboard) must be burnt. The S.A.N.D.F. should utilise the portable littergon incinerator, which would be ideal in the field. He emphasised that the littergon incinerator is for domestic waste only and is *not* to be used for burning medical waste. Cans should be collected from the T.B. and recycled, the nearest recycling centre being in Empangeni. The current waste management practice of dig, burn and bury must should be stopped immediately because the area is

considered to be pristine. Therefore, on ethical grounds alone, the S.A.N.D.F. should change the manner in which it deals with waste. If domestic refuse has to be buried, it should be buried in shallow pits (maximum 1 metre in depth, allowing for a 20 cm freeboard to cover with soil). Pits should be located well away from any water source and pit latrines should be positioned away from boreholes, pipelines, dams and springs. A G.I.S. map, indicating the position of these water supplies, is available from Miss N. May at D.W.A.F.

When asked about the location of the landfill site nearest to the research area, Mr Joubert said that there is one at Pongola and another at Mkuze. Mr Joubert also mentioned that, although there was a Water Quality Officer, a Mr W.Oosthuizen, servicing the area, not many fines are issued, as this department is over-extended and, in any case, court cases would be too time-consuming. Mr Oosthuizen admitted that he had not been to the research area in over a year. He is felt that D.E.A.T. and D.W.A.F. should work together on projects in order to achieve success. He indicated that there is currently tension between the departments concerned and that this obstructed service delivery. Mr Joubert observed that the capacity of his section would strengthen once it integrated with the Catchment Management Agencies (CMA), as its role would be to provide monitoring and advisory services to the CMA.

The management of human waste in the research area is being addressed by the Sanitation Section of D.W.A.F. According to Mr Viv Naidoo, the Assistant Director of Sanitation, a Community Water Supply Unit (C.W.S.U.) was established in 1996. The C.W.S.U. provided municipalities with guidelines to draw up business plans, which would identify priority areas for the provision of human waste services. Once these plans are drawn up, they will be submitted to the C.W.S.U. for approval. Funds would then be made available to the municipality for the project. An amount of R1200 per household was budgeted to build a ventilated improved pit (V.I.P.) costing R900 per unit and R300 would be allocated for educating the local people on the use and the maintenance of the V.I.P. A V.I.P. is a pit latrine with a vent pipe over which a fly screen is fixed. Due to the high water table in the research area, a raised double pit V.I.P. or a dry system V.I.P. is recommended.

5.4.4 Comments and Recommendations from the D.E.A.T.

Mr Stewart Green, Environmental Officer for the Department of Agriculture and Environmental Affairs (D.A.E.A.), is of the opinion that the S.A.N.D.F. must comply with the Environmental Policy White paper and the I.P.W.M. Current waste management practices in the research area are regarded as illegal dumping and the S.A.N.D.F. should find a new way to dispose of the waste generated. The S.A.N.D.F. has drawn up on E.I.P. and therefore, according to Mr Green, an alternative solution must be devised. An immediate response would be to establish a communal site that will comply with the minimum requirements of D.W.A.F. According to Mr Green, the research area has been identified by government as a point of high poverty and is a Presidential Focal Point. A business plan has been drawn up by D.E.A.T. in partnership with the Independent Development Trust (I.D.T.) and funding from Belgium will facilitate the implementation of the project. A site, which belongs to D.E.A.T., has been identified as a potential landfill site in Jozini and, in the meantime, a recycling centre is already being established in Jozini and is being run by Muzi. Mr Green said that the long-term solution was to collect the waste from the deployed area and transport it to Ndumu, as a transfer station for temporary storage, after which it must then be transported to Jozini. Recyclables would be sent to the recycling centre and other waste would go to the landfill site. The recycling centre will accept unsorted waste but no money will be paid to the S.A.N.D.F. for the material. The S.A.N.D.F. will be charged a tariff to dispose waste at a landfill site and currently the nearest landfill site is in Hluhluwe. A consultant has been appointed to manage this project and to educate the local population on the social and environmental benefits of recycling.

5.4.5 Comments by the Umhlabyalingana Municipal District

Mr J.Coetzee, Director Technical Services, mentioned that a consultant had been appointed by D.W.A.F., to assess the waste management situation in the research area and that he was waiting for the final report from the consultant. He is of the opinion that a regional site would be appropriate, but the high water table in the area does not leave many options available for the establishment of municipal landfill sites.

For Houcraft (2002) the major disadvantage in the development of a regional site, would be the higher transport costs. Development of individual landfill sites by each

municipality would have the advantage of reduced transport costs and job creation, the disadvantage of this option being individual permitting and the maintenance of higher standards by trained staff at each landfill site as well as a high closure rate (Houcraft, 2002). Mr Coetzee stated that a Water Services Development Plan is in place to address the sanitation backlog. The study area has been identified as a priority area due to the high water table and will be the next project to be implemented.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The broad aim of this study was to determine the legal requirements of waste management and the sanitation practices of the S.A.N.D.F. at the deployment sites in a rural area in Northern KwaZulu-Natal.

This chapter outlines the conclusions, based on the findings of this research and the discussions in Chapter five. Thereafter recommendations are made with a view to improving the waste management and sanitation practices of the S.A.N.D.F. in the research area.

6.2 Planning and Preparation of Deployments

The planning and preparation for deployments by the S.A.N.D.F. entails many activities. One of these activities is liaising with various authorities such as the South African Police Services, Ezemvelo K.Z.N. Wildlife and the tribal authorities. The study revealed that liaison with the tribal authority takes place before and during deployments. The visits and communications are largely one-sided, i.e. members of the S.A.N.D.F. visit the chief but he does not, however, visit the deployed soldiers. Thus, the manner in which the deployments are conducted is not monitored by the chief. The impact of the deployment on the members of the tribe or on the environment is also not monitored.

Furthermore, visits to the area by the National Departments who are responsible for waste management and sanitation, i.e. D.W.A.F. and D.E.A.T. have not been possible due to staff constraints. This situation is further aggravated, as the E.H.O. of the S.A.N.D.F. is unable to conduct health inspections in the research area, because of transport problems. The research has also revealed that the National Departments were unaware of the S.A.N.D.F.'s presence in these areas. Similarly, the S.A.N.D.F. has not been involved with or informed of the projects by the National Departments

mentioned in Section 3, i.e. they had no knowledge of plans to provide basic waste management services and sanitation to the Umhlabuyalingana municipal district.

As already explained, the vast majority of the population lives in poverty. Khan attributes the lack of participation and involvement of such communities in decision making that impacts on their lives, to their socio-economic circumstances. She goes on to state that the priority of these people is to fulfil basic needs such as housing, water and sanitation. ([http://www.egs.uct.ac.za/sagj/Khan80\(2\).htm](http://www.egs.uct.ac.za/sagj/Khan80(2).htm)) The environment is not perceived to be an urgent issue and therefore is of very little relevance to their lives. The chief and the members of the tribe will therefore only involve themselves in the activities of the S.A.N.D.F. once they have been able to meet their basic needs.

6.3 Waste Management Practices

The findings indicated that various types of waste are generated during deployments. Tin, cardboard, paper and plastic from the ration packs make up approximately 98% of the total solid waste. As stated by Bosman (1998), these items are recyclable and should therefore not be disposed of.

According to the Company Commander, combustible solid waste at the temporary bases should be burnt and the tins should be collected and transported back to the dumpsite at Ndumu. Information obtained from the soldiers on this aspect revealed that 30% of the soldiers also felt that solid waste should be managed in this manner. However, when questioned on how solid waste was managed during deployments, 86% of the soldiers mentioned that all waste at the T.B. is placed in a trench and is burnt. During patrols, solid waste is either brought back to the T.B. or it is left in the field. As no funds are budgeted for the provision of bins and bin bags for proper management of refuse during deployments, soldiers are not able to collect and store the solid waste for removal to the dumpsite at Ndumu.

In addition, there is the lack of availability of a vehicle to transport the waste from the deployed areas to Ndumu. Waste management in the research area will not improve until these items are budgeted for and provided to the deployment region.

Regarding the instructions that soldiers receive on waste management, the questionnaire elicited varied responses on who issued the directives. It emerged that all soldiers receive basic training and that aspects of waste management and sanitation in the field are covered in detail during this process, but the researcher is in grave doubt as to whether any further guidelines are provided after basic training. The lack of sustained control of waste management as well as an absence of reinforcement of the basic principles is bound to lead to unacceptable practices. The absence of bins, bin bags and transport for waste also results in ineffective waste management by deployed members. However, the soldiers cannot be held responsible for the incorrect management practices, as the constraints mentioned need to be addressed and rectified at a higher level.

6.4 Sanitation

The sanitation provided at the T.B., i.e. the go-kart method, according to Alcock (1999), can be categorised as a pit latrine. However, the spade and shovel method used during patrols, falls into the category "no facility". The majority of soldiers, i.e. 60% are satisfied with the sanitation provisions. Observation of the go-karts revealed that lids are either broken or missing. Screening of go-karts is also inadequate

6.5 Recommendations

The first step towards improving on the waste management and sanitation practices of the S.A.N.D.F. during deployments in the rural areas is the formulation of a policy on Integrated Pollution Control and Waste Management. Once such a policy has been drafted, the approach of the S.A.N.D.F. in handling waste and managing pollution must be communicated to all its members.

Environmental education throughout the S.A.N.D.F. i.e. from senior management right down to the most junior level is essential to facilitate adherence to policies adopted. Such education will sensitise members to environmental issues and will build capacity within individuals to be concerned about the impact of their activities on the environment and will also encourage deployed soldiers to avoid negatively influencing their surroundings.

It is recognised that S.A.N.D.F. members involved in the planning of exercises belong to the Infantry, which is their field of expertise. Even the provision of environmental education will not equip them with the knowledge necessary to predict and mitigate environmental impacts in the planning phase of operations. It is therefore recommended that professionals within the S.A.N.D.F. i.e. the Environmental Managers, the Environmental Health Officers and various specialists from the Engineering Corps, be included in the planning process. These members will be able to provide the necessary expert advice on environmental and health issues.

It is evident from this research that there is no liaison between the relevant municipalities, State Departments and the S.A.N.D.F. According to Tonn *et al.* (2000) effective environmental decision-making requires internal and external input in order to facilitate understanding of environmental issues so that they may be addressed. The S.A.N.D.F. should liaise with local authorities and familiarise themselves with relevant bylaws and projects in the deployment areas.

Environmental education of members involved in the planning and decision-making of operations and the provision of applicable bylaws will facilitate the inclusion of environmental and social aspects into the current operational planning process. According to Tonn *et al.* (2000:163) "a decision-making process can be adapted to incorporate sustainability concerns, including fostering sustainable environmental and social systems, meeting obligations to future generations." Environmental decision-making in the S.A.N.D.F. must be future orientated, i.e. anticipated social and environmental threats must be mitigated and corrective/rehabilitative actions must be undertaken when necessary.

The current waste management practices of the S.A.N.D.F. in the research area are in contravention of the requirements of the E.C.A. (1989). In order to bring the S.A.N.D.F. in line with the E.C.A. (1989), it is recommended that, in the short-term, a litergon incinerator should be utilised at the T.B. to burn the combustible material and that cans be collected, stored and transported to the dumpsite at Ndumu. Members on patrol must be provided with bin bags and all solid waste must be collected and stored for disposal at the TB in the manner described above. Ninety-eight percent of the waste material from the research area is recyclable and it is therefore recommended that, in the long-term, all the refuse generated at the T.B. and during patrols be collected,

stored and transported to Ndumu. A transfer station must be established at Ndumu where the recyclables can be kept until such time as they are transported to the recycling centre in Jozini. According to Zwane (pers. comm., 2004) recycling agents are available in the Pongola area.

According to the study by Hiscock (2000) the current sanitation practices in the research area have the potential to pollute groundwater. Hiscock (2000) furthermore asserts that once groundwater is polluted it cannot be rehabilitated. The S.A.N.D.F. must therefore find an alternative method of sanitation urgently. Approximately 85% of the population is solely reliant on groundwater for domestic use. Pollution of this water source will therefore place the health and welfare of this section of the community at risk.

In the short-term, Sanitech recommends the use of a Drum type toilet. (Botes, pers. comm., 2004). In the long-term, the S.A.N.D.F. must meet with the relevant role players at D.W.A.F. and the Umhlabuyalingana Regional District Council, who should be included in the current sanitation projects in the research area.

6.6 Conclusion

The current waste management and sanitation practices of the S.A.N.D.F. in the research area are in contravention of national legislation that regulates these activities. The fact that national departments do not have sufficient enforcement officers is no excuse for the S.A.N.D.F. to continue in the current manner. In formulating the D.o.D. E.I.P., the S.A.N.D.F. has committed itself to integrated environmental management. Environmental protection should be part of the S.A.N.D.F.'s overall management system, including the planning and preparation for deployments. It is of vital importance for the S.A.N.D.F. to make urgent changes to the manner in which solid waste and human waste are managed during all deployments. Failure to do so will result in the pollution of groundwater, upon which many poor communities depend for survival.

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¹ For security reasons and in accordance with South African Defence Force Order *The Maintenance of Security in the SANDF* dated February 1997, the names of the respondents may not be made known

APPENDICES

Appendix A: Questionnaire to the Operations Planning Officer, Group Headquarters, Eshowe

1. *To whom does the land (Kwa Mashudu and Farezella) on which the SANDF deploy, belong?*
2. *Does the Defence Force have to obtain authority to deploy on this land and from whom?*
3. *Are there any conditions attached to the authority granted?*
4. *Who is responsible for this liaison?*
5. *Does the Chief visit the deployed area?*
6. *Is there a handing and taking over procedure between the Chief (tribe) and the SANDF?*
7. *Briefly explain the deployment process?*
8. *What factors are taken into consideration in the choice of the area of deployment?*
9. *Are environmental factors taken into consideration, i.e. waste management, pollution control, etc?*
10. *How are the logistics determined for the operation?*
11. *Does the Group supply the deployed company with bins, bin bags and chemical toilets?*
12. *Does the Group inform the deployed company where they can dispose of the waste generated?*

13. *Does the Group have any guidelines w.r.t. to waste management?*
14. *What waste management problems are currently being experienced in the deployed area?*

Appendix B: Questionnaire to the Company Commander of the deployed unit from Potchefstroom.

1. *Prior to deployment, you conduct a reconnaissance of the deployment area. What is the purpose of this exercise?*
2. *Are aspects of waste management covered in the exercise?*
3. *Are aspects of waste management covered in the induction? What instructions do you receive?*
4. *Who issues this instruction?*
5. *List the waste management problems experienced.*
6. *Who are these problems referred to?*
7. *Is any rectification-action taken?*
8. *What aspects of waste management does the company Sergeant Major cover?*
9. *Are there any actions for poor waste management at the deployment areas?*
10. *What actions are taken?*

Appendix C: Questionnaire to the Environmental Health Officer (EHO) of the research area.

1. *As an E.H.O. what are your responsibilities w.r.t. the disposal of solid waste?*
2. *State the number of years that you have been conducting environmental health inspections in the Ndumu area.*
3. *Do you ever visit the deployed platoons at Farezella and Kwa Mashudu?*
4. *How many times have you been out to these areas thus far?*
5. *List the waste management problems experienced in the deployed areas.*
6. *What actions do you take to address these actions?*
7. *Does the base address these issues?*
8. *What can be done to improve on this situation?*

Appendix D: Questionnaire to the soldiers deployed in the research area

1. *List the types of waste generated a) at the temporary base, b) during patrols.*
2. *Are you instructed on what you may/may not do with the waste that you generate a) at the temporary base, b) during patrols?*
3. *What are these instructions a) at the temporary base, b) during patrols?*
4. *Who issues the instructions a) at the temporary base, b) during patrols?*
5. *Do you adhere to the instructions issued?*
6. *Are your actions w.r.t. waste management monitored to ensure adherence to instruction? a) At the temporary base, b) during patrols*
7. *How is this waste disposed of a) at the temporary base, b) during patrols?*
8. *List problems experienced with current waste disposal.*
9. *Do you report these problems and to whom?*
10. *Are the problems addressed?*
11. *What is your opinion of the current methods of waste management?
Satisfied/Dissatisfied.*
12. *Are you provided with toilets at the temporary base?*
13. *Where do you relieve yourself?*
14. *Are you satisfied with this?*
15. *Are you provided with toilets during patrols?*

16. *How do you relieve yourself during patrols?*
17. *Are you satisfied with this?*
18. *What, in your opinion, can be done to improve on the sanitation in the field?*

Appendix E: Details of Respondents

Serial #	Rank	Total Questioned	Temporary Base
1.	Staff Sergeant	1	Farazella
2.	Corporal	4	Farazella
3.	Lance Corporal	2	Farazella
4.	Rifleman	5	Farazella
5.	Private	3	Farazella
6.	Captain	1	Kwa Mashudu
7.	Sergeant	1	Kwa Mashudu
8.	Lance Corporal	2	Kwa Mashudu
9.	Rifleman	7	Kwa Mashudu
10.	Private	4	Kwa Mashudu