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AFFAIRS AND TOURISM**

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ANNEXURE H

**NATIONAL WASTE MANAGEMENT
STRATEGY IMPLEMENTATION
SOUTH AFRICA**

RECYCLING

**WASTE STREAM ANALYSIS AND PRIORITISATION
FOR RECYCLING**

4 April 2005

EXECUTIVE SUMMARY

The Recycling Component of the National Waste Management Strategy Implementation (NWMSI) Project aims to develop a realistic and practical approach to increase and extend recycling in South Africa. This report documents the finding of the first output of the Recycling Investigations, i.e. the prioritisation of waste streams for recycling.

The methodology used for this investigation used three approaches, viz. a literature review of waste and waste recycling in South Africa; interviews with stakeholders who are currently involved in recycling of waste commodities; and, consultation with stakeholders through a range of Provincial Recycling Workshops held during the period - October 2004 to January 2005. Key sources of information included: the National Waste Management Strategy (NWMS), and, the Recycling and Waste Minimisation Action Plans and Starter Documents; the Polokwane Declaration and the NWMSI Project Inception Workshop Proceedings; as well as reference to international experiences and perspectives on waste stream prioritisation.

The status quo of recycling in South Africa was reviewed and assessed. The elements addressed included: waste management policy and strategy; legislative requirements; recycling objectives, criteria and principles; salvaging of recyclables at landfill sites; drivers and obstacles for recycling; and, the document entitled *Framework for Recycling in South Africa* which had been developed as part of the NWMS Starter Documents for Waste Recycling and Minimisation.

The report addresses waste stream identification and characterisation. It briefly presents an overview of waste generation in South Africa at a national level. Unfortunately, there is only limited information on the composition and nature of the waste stream disposed at landfills in terms of recyclables. Historical and current information on the recycling rates for specific commodities are reported, i.e. for paper, metal (cans and scrap), glass, plastics, tyres, organics and inerts (including building rubble). Current initiatives being undertaken by the Department of Environmental Affairs and Tourism to stimulate recycling in the plastic, glass and tyre sectors are reviewed.

The report identifies, reviews and assesses the waste streams and commodities that are being recycled, the current levels of recycling, the mechanisms for waste collection and processing, and the drivers for and barriers against recycling. The potential for further recycling for each waste stream has been assessed. The results are used as a basis for identifying and selecting priority waste streams for further investigation for pilot studies under the NWMSI Project. The waste streams that scored high in terms of priority for pilot investigation were: tyres, electronic waste, building rubble, paper, glass, plastics, organics and scrap steel. A separate proposal has been developed for NWMSI Project recycling pilot projects and investigations to address some of these prioritised waste streams.

In addition to meeting the primary objectives of the study, i.e. to prioritise the waste streams for recycling, the outcomes of this waste study may also prove useful for:

- Focusing the Department of Environmental Affairs and Tourism's efforts in terms of the development of recycling - policies, legislation, incentives and future initiatives; as well as
- Providing a practical basis for the NWMSI Project Waste Information System development team to use the identified priority waste streams as indicators of the success of recycling.

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ABBREVIATIONS AND ACRONYMS

CPU	Central Processing Unit
CRT	Cathode Ray Tube
DANIDA	Danish International Development Agency
DEAT	Department of Environmental Affairs and Tourism
DPLG	Department of Provincial and Local Government
DWAF	Department of Water Affairs and Forestry
EPR	Extended Producer Responsibility
GSA	Government of South Africa
HDPE	High Density Poly-Ethylene
IP&WM	Integrated Pollution and Waste Management (Policy)
IWMPs	Integrated Waste Management Plans
LDPE	Low Density Poly-Ethylene
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRFs	Material Recovery Facilities
NEMA	National Environmental Management Act
NGOs	Non-Governmental Organisations
NWMS	National Waste Management Strategy
NWMSI	National Waste Management Strategy Implementation (Project)
PET	Poly-Ethylene Terephthalate
PP	Poly-Propylene
PPE	Personal Protective Equipment
PVC	Poly-Vinyl Chloride
PS	Poly-Styrene
PST	Product Stewardship
SANS	Standards South Africa
SATMC	South African Tyre Manufacturing Conference
SAWIC	South African Waste Information Centre
SMEs	Small and Medium Enterprises
USA	United States of America
US EPA	United States Environmental Protection Agency
VCR	Video Cassette Recorder
WIS	Waste Information System

1 Introduction

The objective of the *Recycling Component* of the *National Waste Management Strategy Implementation* (NWMSI) Project is to develop a realistic and practical approach to increase and extend recycling in South Africa. The planned outputs of this component of the Project are:

- Waste streams prioritised for recycling (Output 3.1);
- Recommendations on extended producer responsibility (Output 3.2);
- Needed information from Waste Information System (WIS) specified (Output 3.3);
- Increased use of waste exchange system (Output 3.4); and
- Crosscutting issues addressed (i.e. integrated waste management planning; capacity building and awareness raising; supporting legislative requirements; appropriate institutional structures; funding mechanisms; and appropriate pilot projects and information dissemination) (Output 3.5).

The report documents the finding of the waste stream analysis and prioritisation investigation (Output 3.1). This introductory section:

- Sets out the scope and purpose of the study;
- Provides background information on the Polokwane Declaration and the National Workshop on Waste Management held in Port Elizabeth, both of which set the context within which the study was undertaken;
- Briefly reports on the NWMSI Project Inception Workshop which has directed the study; and
- Provides an overview of the report structure.

1.1 Scope and Purpose of Report

The report addresses Activity 3.1.1 of the *Recycling Component* of the *NWMSI Project*, viz. ‘*Identify Waste Streams that can be Recycled.*’ The Project Document further specifies that:

‘The waste streams that can be recycled are identified, the current levels of recycling, the mechanisms for collection and processing and the drivers for, and barriers against, recycling these wastes will be established. The potential for further recycling for each waste stream will be identified. Prioritise the streams and select two streams for further investigation.’

Hence, the purpose of this investigation was to review all components that make up the waste stream (both *general* and *hazardous* waste) for feasibility for recycling, and to provide guidance on the implementation of initiatives for sustainable recycling, in a phased and prioritised manner. The Department of Environmental Affairs and Tourism (DEAT) will use the outcome of this study as a basis for pilot study investigations as foreseen in NWMSI Project Output 3.5. The specific intension set out in the Project Document is to identify:

- One waste stream/commodity which is currently being recycled and still hold significant potential for optimisation and increased recycling; and
- One waste stream/commodity which is currently not being recycled to a significant degree, but which holds significant potential for recycling.

It is recognised that recycling is more cost-effective if a number of materials are separated and collected at the same time, than to have a process only for the collection of one material, and this will be taken into consideration in the further prioritisation of waste streams.

In addition to objective set out above, two further uses by DEAT of the outcomes of this waste stream prioritisation study may be:

- to focus its efforts in terms of the development of recycling policies, incentives and future initiatives; and

- to use the identified priority waste streams as indicators of the success of recycling, through its Waste Information System (WIS).

The approach and methodology used to achieve the afore-mentioned objectives were the following. The status quo of recycling in South Africa is briefly presented, as well as the need for identifying waste streams that require priority attention by the NWMSI Project. The main criteria used for prioritising waste streams were: potential for significantly reducing the load on landfill sites, significant impact on the environment, and the potential financial benefits. The report starts by considering waste generation in its totality in South Africa, i.e. the sum total of all 'general' and 'hazardous' waste streams nationally. The focus is then narrowed down to waste disposal at municipal landfill sites, i.e. landfills which receive 'general' waste from domestic, commercial and industrial sources. These general waste landfills make out the overwhelming majority of landfills in the country and are a high priority for all spheres of government, but are particularly important to local authorities who manage them.

The composition of the waste that is disposed of at general waste landfill sites is then analysed, i.e. a waste stream analysis is undertaken. The waste streams / commodities that can be recycled, reused and or treated are identified against a range of criteria. The current levels of recycling, the mechanisms for waste collection and processing, and the drivers for and barriers against recycling these wastes/commodities are presented. The potential for increased recycling for each waste stream is assessed. The results are used as a basis to identify and select priority waste streams for further investigation as possible pilot studies under the NWMSI Project.

Hazardous waste is also a very important category of waste because of its potential significant impact on the health and safety of all who may be exposed to this waste, i.e. those who generate and transport it, as well as municipal staff at landfills and surrounding communities. This report does not deal extensively with hazardous waste, which is addressed more comprehensively under two of the other outputs of the *Recycling Component* of the *NWMSI Project*, i.e. Output 3.2: Recommendations on extended producer responsibility; and Output 3.4: Increased use of waste exchange system. Separate reports have been compiled for these outputs (DEAT, 2004a and 2004b).

1.2 Polokwane Summit and Port Elizabeth Workshop

Representatives of government (national, provincial and local), civil society and the business community participated at the first National Waste Summit held at Polokwane in the Limpopo Province from 26 to 28 September 2001 (Wiechers *et al*, 2002), to address the challenges facing waste management in South Africa. The Summit was held in recognition that waste management should be a priority for all South Africans and that there is an urgent need to reduce, reuse and recycle waste in order to protect the environment. The participants reaffirmed their commitment to the objectives of the IP&WM and the NWMS.

The vision of the Summit was "To implement a waste management system which contributes to sustainable development and a measurable improvement in the quality of life, by harnessing the energy and commitment of all South Africans for the effective reduction of waste". To meet this objective a goal - "To reduce waste generation and disposal by 50% and 25% respectively by 2012 and develop a plan for zero waste by 2022", was agreed by all the participants.

The final outcome of the Summit was captured in the Polokwane Declaration, which outlines the commitments of government, civil society and the business community. The declaration is a political statement of intent, meant to focus the efforts of all three parties to make a paradigm shift from their current positions. The implications for the country of meeting the goal and objectives of this declaration are far reaching. The economic cost associated with attaining this ambitious goal had not been calculated, but would no doubt be significant. The social and environmental cost of not achieving

this goal had also not been calculated, but it was clear that many current waste management practices were unacceptable and unsustainable.

A first practical step toward implementing the goal of significantly reducing waste generation is to identify the different waste streams which make up the total waste stream, and quantify and characterise these streams. Once this has been achieved the waste streams can be prioritised in order that a phased approach may be developed to deal with these prioritised waste streams.

To make the declaration a reality will require a practical and sustainable implementation programme. A National Workshop was convened in Port Elizabeth during 2003, at which the implementation of the National Waste Management Strategy and the goals of the Polokwane Declaration were discussed. The focus was on practical means to achieve these goals. Key elements identified as essential to this process were capacity (both human and technical) to address the task as well as economic means to make it possible to reduce, re-use, recycle and treat waste. Again the need to identify and prioritise specific waste streams for priority and phase attention was stressed. The DEAT and the Department of Provincial and Local Government (DPLG) are addressing the resolutions of the Port Elizabeth Workshop through the development of financial and legal mechanisms to encourage and stimulate integrated waste management.

1.3 NWMSI Project Inception Workshop

The NWMSI Project was designed in 2001 but due to various circumstances implementation only commenced during 2004. During the intervening period there were various significant developments that had to be taken into account in the final design of the project. Need for a thorough update of the 2001 Project Document was therefore identified and DEAT decided to consult with the relevant key stakeholders from the public and private sectors through an Inception Workshop. The objectives of the workshop were to:

- Obtain additional input to the project objectives, outputs and activities;
 - Obtain input into the preliminary project schedule;
 - Debate integrating crosscutting issues; and
 - Discuss the possible pilot projects for implementation under the project.
- The following concerns about recycling and the NWMSI Project, which may be relevant to the waste stream analysis and prioritisation, were raised at the workshop:
- Consider both recycling and waste minimization;
 - Consider extended producer responsibility (EPR) as a means to emphasize waste minimization;
 - Explore opportunities for energy recovery;
 - Encourage waste separation at source especially by households to make recycling more viable and to limit contamination of waste;
 - Involvement of financial institutions in recycling initiatives;
 - Ban some waste streams from the landfill;
 - Create incentives to facilitate recycling;
 - Develop legislation that promotes recycling; and
 - Government to lead by example by buying products made of recycled materials.

Existing recycling initiatives were reviewed and drivers and obstacles for recycling were identified:

Beverage cans: The drivers for recycling of beverage cans are: sustainability of markets, value of the can, infrastructure, networks, and that they are cheaper to use. Barriers for can recycling are: lack of accessibility due to lack of separation from source and long distances to be travelled when collecting in rural areas.

Papers: The drivers for recycling are economic viability of recycling paper and environmental concern. The major barrier for paper recycling is the lack of separation at source.

Glass: Drivers for glass recycling are: High demand, easy to reuse and economical viability. Barriers for glass recycling are: Separation at source, awareness, brand preference, safety hazard and poor supply chain.

Plastic material: Driver for plastic recycling: Money. Barriers for plastic recycling: Expensive processing machinery, low demand for certain types of plastics, some products are seasonal, negative perception about products made of recycled material and contamination due to lack of separation at source.

Tyres: The main driver for tyre recycling is economic viability. Barriers for tyre recycling are: There is no formal structure for collection, low value of scrap tyres, vulcanisation makes it impossible to recover scrap tyre and unsustainable use of scrap tyres.

Used oil: Drivers for oil recycling: Income generation, awareness and no levy. The main barrier to oil recycling is informal collectors.

Many other waste streams with a potential of being recycled were discussed, e.g. organic waste, building rubble and electronic waste. It was agreed that these waste streams are not well known and more information needs to be collected on their recycling viability.

The following suggestions were made regarding the project objectives, outputs and activities:

Output 1: Prioritisation of waste for recycling: Two additional criteria for the prioritisation of waste for recycling were proposed, i.e. cost-effectiveness of recycling and potential for stimulating and enhancing community based recycling.

Output 2: Recommendation for extended producer responsibility: Clearly define the 'producer' of the commodity and create a common understanding of the concept of extended producer responsibility among stakeholders.

Output 3: Increase waste exchange system: Consider health and environmental risks and legal implications; and do not limit to private sector only.

Output 4: Information needed for WIS: Use a standardisation reporting format and consider the major existing initiatives.

Output 5: Pilot Projects: A pilot project on material recovery facility or buy back centre and that pilot project should enhance an existing recycling initiative as well as considering new initiatives.

It was suggested that more workshops should be held to discuss the implementation process and that a wider range of stakeholders should be involved (e.g. collectors).

1.4 Provincial Recycling Workshops

A series of Provincial Recycling Workshops for the NWMSI Project were held between October 2004 and January 2005. These workshops were held to discuss and consult with stakeholders on the NWMSI Project Recycling Component, with the following specific objectives in mind, i.e. to: Raise awareness at provincial and local level of the NWMSI project; Report on progress thus far; Consult with provinces and local authorities to establish their recycling needs, requirements and priorities; Identify existing provincial and local recycling initiatives; and Identify potential projects which may be considered for incorporation as part of the NWMSI Recycling pilot projects. The workshop was aimed at the key role-

players and stakeholders in the provinces and local authorities who are involved with waste recycling or who are affected or impacted by recycling. This included representatives from the following institutions: Provincial waste and pollution management departments; Local authority waste and pollution management departments; Commercial concerns and businesses dealing with waste management and recycling; CBOs and NGOs involved with recycling initiatives; and Recycling companies (e.g. paper, cans, plastics, glass and tyres). The workshops were attended by people representing the aforementioned key role-players / stakeholders.

The key outcomes from the Provincial Workshops included issues, needs and requirements relating to the following: Recycling Policy, Strategy, and Action Plans; Legislation; The Recycling Component of the Integrated Waste Management Plans; Waste Information Systems; Management of Salvaging at Landfill Sites; Major Recycling Initiatives; Markets for Recyclables; Obstacles to Recycling; Improved Co-ordination; Waste Stream Prioritisation; Industrial Waste Exchange; Extended Producer Responsibility; Medical Waste; Capacity Building, Awareness-Raising and Education; The Need for a Recycling Forum; and Pilot Projects and Initiatives. Issues of specific relevance to waste stream prioritisation have been reported in the appropriate sections of this report.

1.5 Report Outline and Structure

The report has been structured to comprise the following sections to provide a thorough basis for, as well as assessment and prioritisation of waste streams for the South African situation:

- Introduction
- International Experiences and Perspectives
- Background to Recycling in South Africa
- Waste Stream Identification and Characterisation
- Prioritisation of Waste Stream
- Conclusions.

2 International Experiences and Perspectives

While the design of an appropriate recycling system is dependent upon local circumstances and conditions, there are nevertheless a number of generic lessons that may be derived from the international experience with recycling that may be of relevance to policy-makers in South Africa. A detailed review of international experiences and perspectives on waste recycling was undertaken by DEAT as part of the National Waste Management Strategy Project (DEAT, 2000a). The main findings relevant to this waste stream analysis and prioritisation study are reported in this section. These findings are supported by more recent studies from the Netherlands (Scheinberg and IJgosse, Undated), Germany (J Griffiths, 2005); the United Kingdom (Sanderson, 2005) and France (Copacel, 2005).

2.1 Common Features of Recycling Programmes

The DEAT study reviewed common features and anticipated trends within the recycling initiatives of the following countries: The European Union (EU), The Netherlands, Denmark, Germany, the USA, India, Kenya, and Botswana (DEAT, 2000a). The following findings were reported (DEAT, 2000a) primarily for the more structured approach to recycling that is evidenced in the selected EU countries and the USA:

- These more structured governmental programmes for recycling demonstrate comprehensive and integrated use of the full range of policy instruments, including directive-based (“command-and-

control”) regulations, economic instruments, voluntary agreements and education/information activities.

- Each of these programmes makes formal statutory provision for recycling. This includes provision for recycling within national environmental and/or waste policy frameworks, within waste management planning activities, as well as through the implementation of specific regulatory measures regarding particular products and/or waste streams. In some instances, such as Germany, a “framework law” on recycling has been implemented empowering the government to implement various regulations to promote recycling.
- Statutory provision for recycling has included for example the following:
 - Setting legally required recycling targets for particular waste streams;
 - Imposing landfill bans and/or recycling requirements for particular waste streams and/or products;
 - Requiring local governments to provide for recycling within their waste management plans;
 - Introducing product take-back requirements;
 - Mandating product labelling schemes to indicate recyclable and/or recycled content;
 - Specifying minimum mandatory recycled content;
 - Mandating the use of certain packaging types, such as the use of reusable containers for particular beverages;
 - Introducing government procurement requirements at national, provincial and/or local level;
- An important feature of many of the recycling programmes within the USA and member states of the EU, is the setting of targets for preferred levels of recycling of particular waste streams. The objective of these targets should be to achieve the “socially optimum” level of recycling. To ensure this, targets should be based on reliable background data relating for example to the market conditions for recycled products and raw materials, and including full consideration for the environmental impacts throughout the life-cycle of the recycling chain for the particular waste stream. The targets should be measurable, realistic yet challenging, and developed with effective participation of stakeholders.
- There is increasing use within these programmes of economic instruments that are aimed at providing incentives for recycling, recovering the full social costs of waste disposal, and/or providing funds to initiate recycling. These instruments include:
 - Waste taxes (such as landfill taxes) aimed at promoting a shift up the waste management hierarchy;
 - Taxes on certain forms of packaging or products (such as batteries) with the aim of reducing their use and/or recovering the full costs associated with their disposal;
 - Deposit refund schemes, particularly for beverage containers;
 - “Pay-as-you-throw” schemes charging households for the collection of domestic waste based on the volume of waste discarded;
 - Provision of government grants and subsidies, for example for infrastructure, transportation, and/or recyclable materials, to assist in initial stimulation of markets for recycled products;
- The increasing use of *co-regulatory instruments* including:
 - Negotiated environmental agreements (or industry covenants) in terms of which industry sectors or individual firms enter into an agreement with national, provincial, and/or local

- government departments with formal commitments relating to recycling within particular processes and/or of products;
 - Public voluntary programmes, including eco-labelling schemes, in terms of which government provides technical, financial and/or marketing incentives for waste generators to participate in recycling initiatives;
 - Unilateral industry programmes, in terms of which industry sectoral organisations, with government recognition, provide incentives for industry members or individual waste generators to undertake recycling;
- The promotion of recycling practices through *public education, information and awareness* initiatives;
 - In addition to the integrated application of these various policy instruments, there is an increasing trend towards the adoption of new *product-based policies* aimed at promoting more environmentally effective management of products throughout their entire life cycle, including where appropriate increasing the potential for recycling throughout the product chain, through initiatives such as “design-for-disassembly” and “design-for-recycling;”
 - Related to this last trend, provision is increasingly being made for the recycling of a larger number of *product types*, including for example motor vehicles, electronic products and “white goods.”

2.2 Evaluation of Recycling Initiatives

In assessing the impact and effectiveness of these structured governmental policies for recycling, a key consideration is to evaluate the extent to which these policies have resulted in increased levels of recycling. In addition, it is important to enquire:

- Whether any increase in recycling rates has been sufficient to offset any concomitant increases in the levels of waste disposed to landfill or incineration; and
- Whether the resulting level of recycling is in fact the economically and environmentally most effective response.

Examining first the extent to which formalised government intervention has resulted in increased rates of recycling, it is evident that in most of the countries there has been an increase in levels of recycling. Within the EU, for example (EEA 1999):

- Paper and paperboard recycling has increased from 36% in 1985 to 49% in 1996;
- Glass has increased from 43% in 1990 to 55% in 1996;
- Plastics recycling has increased by 4% per annum since the mid 1980s.

However, these improvements in recycling rates have generally not been sufficient to reduce, or even stabilise, the overall quantity of waste generated, which has risen by nearly 10% between 1990 and 1995, as compared with an economic growth rate of approximately 6.5 % (EEA 1999). In particular there has been an increase in the generation of glass and plastics waste. For municipal waste, landfilling remains the most common treatment. From 1985-1995 there has been an increase in the amount of municipal waste landfilled from 86 million tonnes to 104 million tonnes. Even if part of this increase may be due to better accuracy in recording data, it is reasonable to conclude that in absolute figures, the EU countries landfilled more municipal waste in 1995 than in the period 1985-90.

Assessing the environmental and economic costs and benefits of the government-imposed recycling programme is a complex exercise. It is essential that detailed cost-benefit analyses of the various policy

options are undertaken prior to introducing policy aimed simply at increasing the level of recycling. It is emphasised however that the results of studies conducted in Europe or the United States should not be seen as necessarily indicative of the results that would be found for similar reviews in South Africa (DEAT, 2000a).

2.3 Key Findings and Recommendations

The key to sustainable recycling is finding a balance between securing the supply of recyclable materials and promoting the demand for products that are made from these materials, while appraising the social, environmental and economic impacts (DEAT, 2000a).

Internationally, recycling initiatives are formalised as in the case of the EU and the USA or less structured as implemented in Kenya, India and Botswana. Formalised structures rely on government intervention to enhance market conditions to promote recycling. Policy instruments that have been implemented include directive-based regulations, economic instruments, voluntary agreements and education/information activities. These have resulted in an increase in the level of recycling but have not significantly impacted on the total quantity of waste generated.

Several European studies have demonstrated diminishing returns on the environmental benefits with increasing recycling rates. Life cycle analyses of some wastes, e.g. plastics and paper identify the incineration of the waste with energy recovery as providing the greatest environmental benefit and most cost-effective solution. In Europe incineration is generally favoured over landfilling of waste.

Although the design of an environmentally and economically effective recycling system is dependent upon local conditions, a number of lessons may be learnt from international experiences. These include:

- Prior to the implementation of a recycling programme, a detailed evaluation of the economic, environmental and social impacts of recycling need to be undertaken. This should include an assessment of the life cycle costs associated with recycling, as compared with alternative methods of disposal.
- Markets for recycled commodities need to be stimulated to promote more profitable recycling and create jobs.
- A National Forum should be constituted comprising stakeholders of all sectors of the recycling chain, for discussing mechanisms to promote recycling and monitor their effectiveness.
- The co-ordinated implementation of policy measures aimed at: integrating recycling within waste management planning, increasing public awareness of the benefits and methods of recycling, and stimulating ongoing adoption of market-driven recycling initiatives;
- An investigation into extended producer responsibility needs to be undertaken to identify its feasibility to promote recycling.
- Co-ordination of the proposed evaluation of recycling evaluation with a project currently ongoing with government in partnership with DANCED to identify and evaluate market-based instruments appropriate to waste management, including recycling.
- One initiative or approach will not necessarily meet all the identified needs in South Africa and geographical, demographic and socio-economic differences will have to be taken into account in designing localised recycling programmes.

3 Background to Recycling in South Africa

Waste recycling, i.e. the external recovery, reuse and/or reprocessing of post-consumer and post-production wastes, is an important part of the waste management hierarchy (Borland *et al.*, 2000). The

objectives of recycling are to save resources, as well as reduce the environmental impact of waste by reducing the amount of waste disposed at landfills. In addition, recycling has the potential for job creation and is a viable alternative to informal salvaging at landfills, which is undesirable due to the associated problems of health and safety.

A number of new developments South Africa in the political, policy and legislation fields, e.g. the Constitution (GSA, 1996), the Environmental Management Policy (DEAT, 1998), the National Environmental Management Act (GSA, 1998), the Integrated Pollution and Waste Management Policy (2000b) and the National Waste Management Strategy (1999a), resulted in a re-appraisal of the recycling situation. Integrated waste management requires the implementation of a hierarchical approach to waste management, involving a sequential application of waste prevention, minimisation, re-use, recycling, treatment and ultimately disposal. Hence, recycling is an integral part of the way waste management is being implemented in South Africa.

The majority of commercial waste recycling initiatives have been developed on an *ad hoc* basis and have been funded by the private sector, with minor financial inputs from the authorities. The authorities have tried to stimulate waste recycling assisting with establishing waste buyback centres and garden waste drop-off centres in the larger cities and towns, at which waste is separated into different waste streams, such as glass, paper/cardboard, cans, scrap metal, plastics and garden waste. A number of capital-intensive recycling plants have been launched but have been unsuccessful in South Africa. Although these plants worked from a mechanical point of view, their failure has been attributed to an over-estimation of the value of recoverable materials, unrealistic requirements of the municipalities involved, and a downturn in the economy at the time the projects were launched.

There are no formalised systems for source separation of waste in South Africa, although various trials are underway. Due to the large quantities of recyclable materials in the waste arriving at landfill sites, informal salvaging is widespread. This practice leads to unacceptable health and safety risks for the salvagers, as well as operating problems for the landfill staff.

The implementation of successful recycling initiatives is not a short-term activity but rather an ongoing initiative that must be reviewed and revised based on experience. An ongoing campaign will be required to change people's behaviour and to take responsibility for their waste. All stakeholders must take responsibility and their activities need to be integrated into holistic waste management planning.

The Polokwane Declaration (DEAT, 2002) represents a significant initiative by all South African stakeholders in the waste management field to improve this practice. The Declaration objective is to grow the recycling industry by 30% by 2012. The vision is broad and the level of ambition is high, but the reality is that the objective will be difficult to achieve. The aim of the NWMSI Project is to work in line with and support the Polokwane Declaration, *inter alia* through the planned NWMSI Project pilot projects.

Recycling is not a *panacea* for environmental problems nor should it be pursued to the point of diminished returns or at any cost. A full appraisal of the social, environmental and economic benefits and cost of recycling, in comparison with one-way consumption and disposal of used products and packaging is essential to decide on the appropriate roles and mechanisms for recycling, for specific circumstances.

This section of the report provides further background on recycling in South Africa, with a view to waste stream prioritisation for recycling, covering the following aspects:

- Waste Management Policy and Strategy
- Legislative Requirements
- Recycling Objectives, Criteria and Principles

- Post-Consumer Recycling of Waste
- Salvaging at Landfill Sites
- Drivers and Obstacles to Recycling
- A Framework for Waste Recycling.

3.1 Waste Management Policy and Strategy

Integrated waste management requires the implementation of a hierarchical approach to waste management, i.e. a sequential application of waste prevention/minimisation, recycling and re-use, treatment, and ultimately disposal. Hence, recycling is an integral activity in the way waste management will be implemented in the future. The policy and strategy vision for these preventive and proactive waste management steps are, that the rate of increase of increase of waste disposed to landfill sites will be slowed down and informal salvaging at landfills will decrease. Natural resources (renewable and non-renewable) will be better conserved, landfill air-space will be more effectively utilised, and pollution and environmental degradation will be reduced. In addition, recycling has the potential for job creation, by promoting entrepreneurs to establish community collection systems and recycling centres.

The publication by Government of its White Paper on Integrated Pollution and Waste Management (IP&WM) for South Africa (DEAT, 2000b) has heralded a new approach to waste management, a move away from traditional ‘end of pipe’ solutions to a holistic integrated approach. This policy sets out the principles that underpin the National Waste Management Strategy (DEAT, 1999b). The National Waste Management Strategy (NWMS) translates the policy principles into high level strategic plans and actions. The key elements of the IP&WM and the NWMS are currently being formulated as draft legislation. The emphasis will be on holistic and integrated waste management following the waste hierarchy approach (see Figure 1), i.e. starting with waste prevention as the highest priority, followed by waste minimisation, waste reuse and recycling, and only thereafter, waste treatment and finally waste disposal.

For the purposes of the NWMS, *waste minimisation* was defined as any activity that is undertaken to prevent or reduce the volume and/or environmental impact of waste that is generated, treated, stored or disposed of (DEAT, 1999a). Waste minimisation refers specifically to activities taken by a waste generator relating to source reduction and/or internal recycling (some examples of activities associated with waste minimisation are provided in Figure 2). Initiatives for the *external* recycling of post-consumer and post-production material – such as packaging waste, glass and paper – are referred to as *waste recycling*. Waste recycling includes the separation at source of recyclable materials and the reuse of such materials, and refers to both general and hazardous wastes. The nature of the distinction between waste minimisation and recycling is highlighted in Figure 3.

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

Figure 1: Waste Management Hierarchy

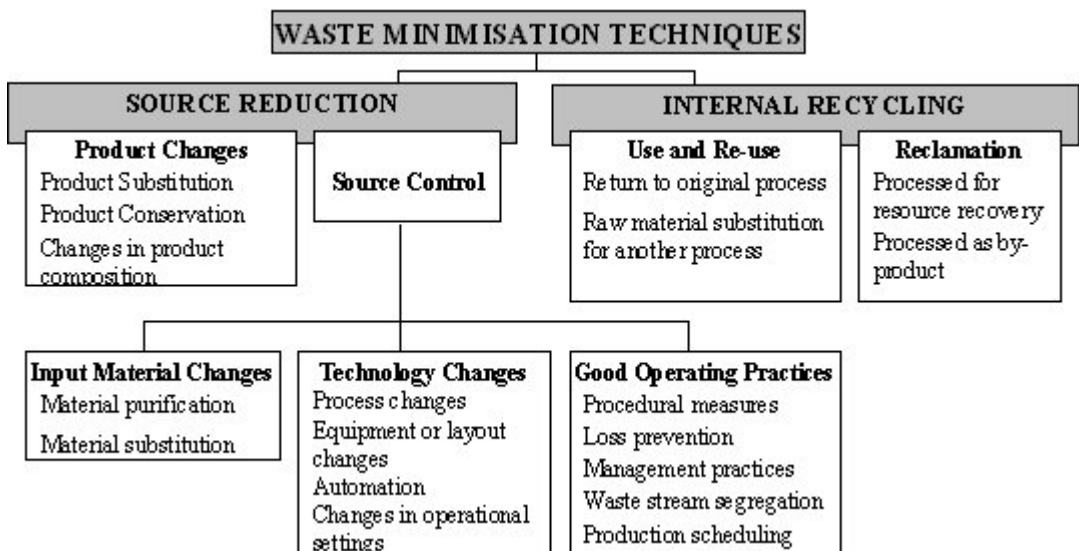


Figure 2: Outline of Traditionally Applied Techniques for Waste Minimisation (Adapted from US EPA’s Waste Minimisation Opportunity Assessment Manual)

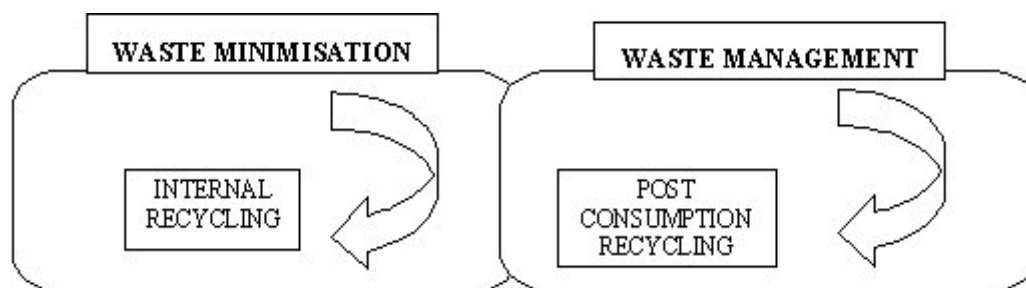


Figure 3: This diagram emphasises the distinction between "internal recycling" (a technique for waste minimisation) and "external recycling" (the second item on the waste management hierarchy).

3.2 Legislative Requirements

A *Legal Framework Document for Recycling* was prepared as part of the DEAT programme for the Implementation of the NWMS (DEAT, 2000d). The document presents a draft framework of the legislative action required for the implementation of recycling in South Africa. The suggestions contained in this report form part of a continuing consultative process relating to waste management in South Africa, and will need to be considered in the light of developments with the current legislative reform process being managed by the Department of Environmental Affairs and Tourism (DEAT). Most of the suggestions contained in this report are contingent upon developments within the law reform process and must be seen in this light.

An important element of the Action Plan for Waste Minimisation and Recycling (DEAT, 1999a) is the promulgation of legislation at national, provincial and local government level. This requires specific provision for recycling within the anticipated "Integrated Pollution and Waste Management (IP&WM) Act" (currently the *Draft Waste Management Bill*), the possible development of interim regulations in terms of the Environment Conservation Act and/or the National Environmental Management Act, as well as provision for recycling within relevant provincial and local government legislation.

The Framework Document identifies the following issues for consideration:

- Specific provision for recycling should be made within national framework legislation pertaining to integrated pollution and waste management, with provincial legislation and local government by-laws providing further substance and detail.
- At a general level the following priority issues need to be provided for within the legal framework to promote recycling:
 - A review of recycling initiatives and related policy measures that have been implemented in South Africa and internationally, with an assessment of the reasons for the relative success and/or failure of these initiatives;
 - Procedures for setting and periodically reviewing appropriate recycling targets for defined waste streams;
 - Requiring local and provincial governments to include recycling within integrated waste management plans;

- Requiring particular industrial sectoral organisations to develop recycling business plans for meeting government's recycling targets;
 - Promulgating regulations requiring recycling considerations to be included within government procurement practices;
 - Ensuring provision for recycling issues within requirements relating to the development of the Waste Information System;
 - Ensuring appropriate allocation of responsibilities for recycling;
- In this regard, specific provision for recycling should be made in the Draft Waste Management Bill, *inter alia* for:
 - The adoption of policy and guiding principles reflecting the importance of the waste management hierarchy;
 - Procedures for setting and periodically reviewing appropriate recycling targets for defined waste streams;
 - Requiring local and provincial governments to include recycling within integrated waste management plans;
 - Requiring particular industrial sectoral organisations to develop recycling business plans for meeting government's recycling targets;
 - Promulgating regulations requiring recycling considerations to be included within government procurement practices;
 - Ensuring an appropriate definition of waste;
 - Providing for the required institutional arrangements for recycling;
 - Ensuring that the Waste Information System provides appropriate baseline data to identify priority targets for recycling, and to monitor progress in achieving these targets;
 - Empowering the Minister to promulgate required regulations relating to recycling, including possible future regulations relating for example to:
 - Defining recycling requirements for particular waste streams;
 - Requirements relating to extended producer responsibility;
 - The introduction of product labelling;
 - Requiring reductions in excess packaging;
 - Specifying minimum mandatory recycled content;
 - Mandating the use of certain packaging types;
 - Provide for the establishment of possible funding mechanisms to assist in the development and implementation of recycling initiatives.
- Pending enactment of the anticipated Draft Waste Management Bill, and in parallel with the development of this Act, regulations relating to recycling may be promulgated in terms of the Environment Conservation Act and/or the National Environmental Management Act. The need for interim regulations, and the possible choice of Act for these regulations, is dependent upon the timing and related developments within the Environmental Law Reform Programme, and in particular on the anticipated relationship between NEMA and the Draft Waste Management Bill.
 - It will be necessary to address the issue of possible duplication and/or conflict with any existing legislation that may have an impact on recycling issues.

A key goal of any legislative intervention for recycling should be to ensure a clear definition and formal allocation of responsibilities for recycling. While the role of provincial and local government legislation is important in promoting recycling initiatives, formal provision should be made at a national level within the proposed framework of legislation within the DEAT Law Reform Process. Recycling considerations - should be explicitly provided for within the waste management plans, should impact on the nature of the information collected as part of the Waste Information System and may influence the nature of economic instruments that are developed for waste management purposes.

3.3 Recycling Objectives, Criteria and Principles

In the *Starter Document for Waste Recycling: A Framework for Sustainable Post-Consumer Recycling in South Africa* (DEAT, 2000a), the following objectives for promoting and expanding recycling initiatives are proposed:

- Job creation;
- Reduction of pollution and the conservation of natural resources;
- Conservation of energy and reduction of costs in manufacturing sectors;
- Litter abatement;
- Reduction of the waste stream to landfills;
- A reduction in and eventual elimination of scavenging on landfills.

The above can also be used as criteria for identifying, assessing and prioritising waste streams for recycling. The NWMSI Project Provincial Recycling Workshops (DEAT, 2005a) identified the following additional criteria which should be considered in prioritising waste streams for recycling:

- Due consideration of health and safety risks;
- Available quantities and value of the material / commodity being recycled;
- Existing and potential markets for the material / commodity being recycled;
- Separability from the waste stream;
- Bulking factor for landfills;
- Recycling options;
- Access to regular and reliable data;
- Existing recycling initiatives, programmes and Memoranda of Understanding (MOUs).

In addition to the above criteria, the following principles should also be considered identifying, assessing and prioritising waste streams for recycling (DEAT, 2000a):

- *Equity:* There should be equitable access to environmental resources, benefits and service to meet basic needs and ensure well-being.
- *Full-cost Accounting:* Decisions must be based on an assessment of the full environmental cost and activities that impact on the environment. This is a difficult principle to apply in practice; the full environmental costs are usually not available.
- *Inclusivity and Participation:* Environmental management processes must consider the interests and values of all interested and affected parties in decision making to secure sustainable development.
- *Integration:* Integration of environmental, social and economic considerations in the achievement of sustainable development, management and execution of functions.
- *Polluter Pays:* Those responsible for environmental damage must pay the repair cost both to the environment and human health and the cost of preventative measures to prevent or reduce further pollution and environmental damage.
- *Economic Instruments* should be used as incentives for recycling or to provide funding to implement recycling initiatives.

3.4 Post-Consumer Recycling of Waste

In the National Waste Management Strategy, the term recycling is used in its broadest sense, and refers to the related processes of resource recovery, and the processing of recyclable materials recovered from

both the general and hazardous waste streams DEAT (1999b). The recycling of waste forms an important part of the waste management hierarchy (see Figure1) and is one of the overriding principles upon which the NWMS is based.

In South Africa, post-consumer recycling activities are mainly undertaken by private recycling companies, especially those associated with the packaging industry (DEAT, 2000c). Additionally, many local authorities have established voluntary drop-off facilities and buy-back centres to encourage and stimulate post-consumer recycling. In some instances, local authorities have implemented the kerbside collection of separated recyclables with their normal waste collection services. In support of these initiatives, a number of ongoing education and awareness programmes that promote recycling have been developed (DEAT, 2000c).

The level of recycling is influenced by socio-economic and demographic factors. Monetary incentives are of prime importance in the lower socio-economic income groups and environmental concerns drive recycling behaviour in the middle to upper income groups (DEAT, 2000a). South African recycling statistics for paper, cans, plastics and glass over the period 1990 to 2004, are listed in Table 1. The percentages recycled materials reported by the major recyclers are relatively high. However, notwithstanding these high levels of recycling, estimates of recyclables in the waste streams at landfill sites indicate that there are still significant quantities being disposed of to landfill sites.

Table 1: Recycling Statistics for South Africa (DEAT, 2000a & 2004b)

Waste	Percentage Recycled					
	1990	1992	1994	1996	1998	2004
Paper	29	28.4	38	38	38	52
Cans	21	26.3	29.9	51	67	85
Plastics	11	14.8	17	17	12	14
Glass	14	22.4	19.4	17.6	20.8	22

No standard and/or regulated mechanism exists for implementing and funding recycling. The majority of initiatives have been developed on an *ad hoc* basis and have been funded by the private sector, with relatively minor financial inputs from the authorities. As a result recycling initiatives have to be financially viable in order to be sustainable. This contrasts with the practices in many of the developed countries, e.g. the USA and Europe where the significantly higher disposal fees are utilised to cross-subsidise recycling initiatives. In South Africa the only commodity which is partially subsidised is the recycling of metal cans (by ISCOR and NAMPAK) which has had a stabilising influence on the recycling of this specific waste stream. There are a number trials are underway with source separation of waste in South Africa, e.g. the so-called 'two-bag' system, but the practice has not been formalised to any significant extent.

3.5 Salvaging at Landfill Sites

Due to the large quantities of recyclable materials in the waste arriving at landfill sites, informal salvaging as a form of income generation for the very poor is widespread in South Africa. At almost all general landfills sites, significant numbers of unemployed families make a living through uncontrolled salvaging and controlled reclamation. While reclamation of the waste stream from waste disposal sites is a reality in South Africa (and in many other developing countries), this practice can endanger the health and safety of the reclaimers, whilst creating serious operational problems for the operators/permit holder of landfill sites, who are legally responsible for the safety of these reclaimers on their landfill sites.

The waste salvagers reclaim materials which are saleable from the landfills, such as paper, cardboard, plastic, glass, tins and scrap metals. Although salvaging provides a source of income to the reclaimers, a wide range of problems is experienced with this type of practice on the landfills:

- Little or no formal recognition of reclaimers by the landfill owners and operators, since in effect these reclaimers illegally work (and live) on these sites.
- Inferior quality of recyclables salvaged from the wet and dry mixed waste stream;
- Low prices offered by waste brokers (agents) for contaminated recyclables, i.e. exploitation of the salvagers;
- Dishonesty in both selling and buying practices;
- Fluctuating market prices for recyclables, due to fluctuating demand for recyclables;
- Interference with landfill operations which is not only having a negative impact on the efficiency with which the landfills are operated, but it is also putting the safety of reclaimers at risk;
- Reclaimers create aesthetic problems on landfills through windblown litter from separated materials as well as uncovered waste due to interference with the compaction and daily cover. Waste is often scavenged from waste bins at the point of generation (outside domestic premises and businesses and shopping centres), as well as from vehicles even before it reaches the official disposal area, resulting in waste littering and waste dumping in unauthorised areas;
- No ablution facilities for informal salvagers, resulting in unhygienic conditions in and around the waste disposal site;
- Uncontrolled access to landfill sites, resulting in the presence of animals and children together with the salvagers;
- Contaminated food scavenged from the waste stream, which is consumed by salvagers or taken home for their families;
- Development of informal settlements close to or on top of waste disposal sites where no municipal services are available and living conditions are in general unhealthy and unsafe;
- Creation of open fires by salvagers during winter months with the associated risk of landfill fires, and the increased risk of air pollution as well as the associated health risk for the people on and around the waste disposal site. Tyres are often burnt as a form of heat generation;
- The uncontrolled presence of large numbers of people on the waste disposal sites increases the security risks for both the landfill operating staff as well as the landfill users. Public vehicles are often hijacked under such conditions;
- Unsafe and unpleasant conditions at the waste disposal site results in increased illegal dumping by members of the public who are discouraged from disposing waste at these disposal sites;
- Exposure to hazardous waste that might be illegally dumped on the landfill site (e.g. health care waste and abattoir waste); and
- Little or no reliable statistics on waste salvaging.

Attempts to stop salvaging at landfill sites by the authorities have at times met with significant opposition from the salvagers with threats of violence, since for many of these persons this is their only means of income. As a compromise, some authorities have investigated and implemented systems, which allow salvaging under strictly controlled conditions at landfills. In general, the process followed for controlled salvaging is as follows:

- All existing reclaimers on the landfill site are registered;
- A formal waste transfer/sorting structure is provided for the salvaging of recyclable materials from the incoming waste stream before the tailings is being landfilled;
- In close proximity to the sorting structure various facilities are provided, e.g. a site office; ablution facilities for both males and females and change rooms;
- All registered reclaimers undergo training on health and safety adherences;
- All registered reclaimers are issued with the required personal protective equipment (PPE);
- All registered reclaimers are issued with identification documentation;
- Registered reclaimers elect a control committee and chairperson as a formal structure for interaction with the municipal authorities;

- A joint bargaining mechanism is created by registered reclaimers to negotiate with agents for better tariffs for recyclable materials recovered; and
- The reclaimers to have regular control meetings on site at which problems are raised.

This process is functioning with variable degrees of success at a number of landfills in South Africa. Various problem remains remain unresolved, e.g. controlled salvaging still has a significant impact on the disposal site operation due to the requirement of the double handling of waste. Furthermore, although formalised salvaging is a significant improvement over informal salvaging at the landfill work face, the conditions under which salvagers are working are still not ideal. A few municipalities have agreed to allow recycling infrastructure on their landfills as a means to accommodate salvaging and formalising this practice.

One proposal which is being considered by the waste industry is to create landfill reclaimer cooperatives. For example, the Tshwane Municipality has registered a cooperative for landfill reclaimers in Tswane and has built buy-back centres at two of their major landfills. However, the challenge that the Tshwane Municipality have been faced with has been to find a suitable operator that will take ownership and management responsibility for the cooperative. This lack of a formal management structure has resulted in sub-optimal management and ineffective use of infrastructure.

A structured approach to deal *inter alia* with the problems associated with salvagers on landfill sites is under development by the Department of Water Affairs and Forestry (DWA) and is set out in a draft document entitled: *Minimum Requirements for Upgrading Waste Disposal Operations (Draft)* (DWA, 2003).

3.6 Drivers for Recycling

The following drivers for and mechanism to encourage waste recycling were identified and discussed during the Provincial Waste Recycling Workshops held during October 2004 to January 2005 (DEAT, 2005a):

- *Funding:* A number of sources of funding for waste management, and recycling in specific, exist, e.g.
 - Local Economic Development (LED),
 - the Department of Treasury,
 - The Poverty Relief Directorate at DEAT considers and funds environmental projects, including waste recycling,
 - The DBSA provides soft loans for municipal projects, including waste recycling,
 - The DPLG, through its municipal infrastructure grant (MIG) programme, will consider motivations for waste management projects, including waste recycling. However, to date 95% of the funds have gone to other priority areas, e.g. roads and water supply. Municipalities need to develop innovative approaches to obtain funding for waste related projects, e.g. IWMPs should become part of their IDPs and could be funded in this manner,
 - Independent Development Trust (IDT), and
 - Department of Public Works funds projects through its Extended Public Works Programme.
- However, municipalities and other stakeholders need to be capacitated to access these funds. Banks often consider recycling projects as high-risk and are unwilling to provide financing for such projects. Part of the tourism levy should be recovered to manage the waste produced by

tourists. Possible sources of funding are international and local funding agencies (e.g. The Cooperative Waste Group; The Dutch Group, WASTE, DANIDA and DIFID), but it was felt that improved co-ordination is required to optimize the impact of the efforts of funding agencies.

- *Job creation:* The main driver encouraging recycling in the poorer provinces appears to be an economic rather than an environmental need, i.e. there is a high need for job creation because of high levels of poverty and there is a low barrier of entry into this market. Incentivisation of entrepreneurs, possibly through subsidies is being considered. Government could encourage and stimulate recycling in a number of ways, e.g. by tax reductions and rebates on levies for companies that recycle waste or by use of recycled products; and by including recycling as a tender requirement in its procurement procedures.
- *Public/private partnerships:* Because the lack of skills, capacity and capital, private sector involvement in recycling initiatives is seen as crucial. Public/private partnerships are seen as a mechanism for encouraging recycling initiatives. Private recycling companies, especially those within the packaging industry, are the main drivers in terms of commercial recycling. These activities include the recycling of paper, cardboard, plastics, glass, oil, rubber (scrap tyres) and motorcar lead-acid batteries. In the informal sector, especially in less developed areas, various commodities (plastic bags, beverage cans and glass bottles) are re-used to make innovative products, for example bags, mats, toys and other items for sale and income generation.
- *Drop-off and buyback centres:* The establishment and support of drop-off and buyback centres by municipalities are considered drivers for successful waste recycling. At these centres waste is separated into different waste stream such as glass, paper, cardboard, cans, scrap metal, plastics, garden waste and disposable waste. Collection banks (igloos) are used on a small scale for glass and paper, whilst green cages are provided for the collection of mixed plastics. Schools, churches and welfare organisations are involved in the collection of recycled material, especially cans, paper and returnable bottles, partly as part of the education in environmental issues, and partly to earn money for the school budgets, or for the needy.
- *Awareness raising, education and capacity building:* The decision makers, i.e. politicians, councillors and officials in local municipalities need to have a change in mindset regarding waste management and recycling. This can be achieved through awareness raising, education and capacity building. The NWMSI Project pilot studies will be used as a means of to achieve this, with a focus on capacity building to address the lack of technical and entrepreneurial skills.
- *Markets and economic incentives:* The development of markets and economic incentives for recycling would encourage recycling.
- *IWMPs:* The development and implementation of IWMPs are considered a mechanism to encourage recycling.
- *School education programmes,* e.g. the WESSA Education Programme, developed in partnerships with local NGOs, is promoting and encouraging recycling.
- *Legislation, permits and authorizations:* Compliance with recycling legislation, permits and authorizations.
- *Landfill airspace:* A common problem experienced by municipalities is that they are running out of airspace on their existing landfills. New landfills will be more expensive and hence the preservation of landfill airspace is important. Landfilling costs could escalate significantly and so drive other waste management initiatives. Savings in airspace brought about by recycling should be quantified and used to offset recycling costs.
- Other mechanisms identified that would encourage recycling included the following:
 - A central processing facility in each Province to capacitate and assist municipalities unfamiliar with the processes of obtaining financial aid
 - Government setting an example, for example by purchasing recycled paper i.e. it must be part of its procurement procedures.
 - Current recycling initiatives are predominantly run by organized business, but workshop participants felt that involvement by Government could assist addressing changing conditions in the recycling market, for example by creating markets.

- Producers of commodities should be involved in buy back centres, e.g. through mechanisms such as extended producer responsibility (EPR).
- Government and business assisting through subsidising buy-back centres could address the problem of exorbitant transportation costs.

3.7 Obstacles to Recycling

The following obstacles to recycling were identified at the Provincial Recycling Workshops (DEAT, 2005a):

- *Limited or lack of markets:* Problems are being experienced with markets for recyclables particularly glass, newspapers and magazines, paper and cardboard. For example:
 - The Eastern Cape Province is disadvantaged by the inaccessibility of recycling companies, i.e. most of the major recyclers are located in the Gauteng area which results in high transportation cost.
 - Government does not encourage recycling since it does not specify the purchase recycled commodities through its procurement procedures.
- *Fluctuating prices* for recyclables have also fluctuated significantly and as a result many recycling ventures have gone under. For example, in one instance the number of recyclers has decreased from 700 to 300 and there are significant stockpiles of recyclable commodities which have not been sold.
- *Lack of competition:* There is also concern about the lack of competition in the recycling field, which may result to monopolistic practices. There is a need to create new markets for recyclables, over and above the existing large recyclers such as SAPPI, Mondi and Collect-a-Can. The need for government control was raised.
- *Limited Capacity at Local Authorities:* Local entrepreneurs have launched a two-bag system to encourage separation of waste at source; however they have only limited support from local authorities, primarily as a result of a lack of capacity and resources. Separation at source will require different waste collection trucks and the local authorities do not have the resources to purchase such trucks. Most local authorities do not have the necessary infrastructure to recycle waste at their landfill sites.
- *Littering:* There is a general need to change the culture of littering. Material such as paper is not transported appropriately, e.g. paper flying off the trucks during transportation causing littering along the transport routes. The Department of Transport needs to take appropriate actions against waste transporters who transgress the law. It was suggested that Standards for Recyclers be developed and enforced. Informal collection of waste from rubbish bags and bins ahead of formal municipal collection often results in littering.
- *Cable theft:* Telephone cables are stolen for the purpose of recycling copper, which fetches a relatively high price.
- *Unsustainable recycling projects:* A number of unsustainable recycling projects had been started in, but shut down after a relatively short lifespan. It was suggested that recycling initiatives should be registered with an appropriate authority and an EIA should be undertaken.
- *Inappropriate use of waste levies:* Local authorities are not necessarily utilising funds generated as waste management levies for the purpose of waste management. At a national level, the levies raised on plastic bags are not exclusively used for plastic bag related waste management.
- *Coordination of recycling initiatives:* Better co-ordination is required between governmental (national, provincial, local authority), business and community initiatives in waste management and recycling. Workshop attendees reported a lack of coordination which had resulted in problems and inefficiencies in this field.
- *High transportation costs:* The high costs associated with the transportation of recyclables from

the rural areas to the major city centres, where the recycling companies are situated, are prohibitive.

- *Contamination:* Problems are experienced with the recycling of plastics because of contamination of the materials collected by the recyclers from contaminated waste streams on landfill sites. There is also a need for separating out those types of plastics that can be recycled.
- *Access to funding:* Banks consider recycling projects as high risk ventures and are as a rule hesitant to provided loans for these ventures. Support to these ventures by government, e.g. by way of a subsidy, may give greater security to these ventures and improved access to other funding.
- *Lack of Skills:* There is a lack of skills and capacity at the local municipality level in the area of waste management and specifically waste minimisation, recycling and re-use. Environmental health departments can possibly assist with appropriate training by utilising their health inspectors to assist with the process of waste management. Public/private partnerships with industry and the larger recycling companies should be explored.
- *Safety Aspects:* Some recyclables (e.g. plastics, rubber, textile off-cuts) are flammable and recycling companies need to ensure the safety of their workers. The Department of Labour needs to be involved in these issues.
- *Unscrupulous middlemen* in the waste recycling chain are a disincentive for recycling by the poor and uninformed.
- *Commodities which are not recyclable:* Certain commodities are not recyclable, e.g. cardboard boxes with wax covering, plastics and glass.
- *Sustainability of recycling projects:* Problems are being experienced with the sustainability of recycling projects, e.g. the price paid for waste paper has dropped from R1,800 to R600 a tonne. The reason for the reduction in price paid for recovered paper was that there is an oversupply of waste paper, i.e. currently in South Africa 54% of the paper manufactured is recycled and 80% of the cardboard. It was suggested that this problem could be addressed by paying collectors of recyclables a flat rate (as is the practice in the beverage can recycling industry). It was also suggested that prices for recyclables should be stabilized possibly through subsidies or price control, e.g. through a levy as is the case for plastic bags.
- *Lack of Tax Incentives:* There are no direct tax incentives for recycling, as is the case in certain overseas countries, e.g. in Canada such tax incentives are provided to producers who recycle commodities. However, the Department of the Treasury is not in favour of levy systems and problems are being experienced to ring-fence the income from levies, e.g. levies being collected for plastics recycling. The voluntary initiatives appear to hold greater promise.
- *Lack of Incentives:* There is currently no incentive for residents to participate in source separation systems.
- *Lack of BBE:* There is a need for corporate unbundling and black economic empowerment in the recycling industry.
- *Lack of Government support for Community Schemes:* Community schemes should enjoy more support from Local Government (especially in terms of waste transportation). However, local contractors feel that community schemes take work from them. Community recycling initiatives are likely to require high maintenance, especially in the face of high rates of illiteracy.
- *Roles Played by the Authorities:* The traditional roles and functions of the authorities, permitting and enforcement, need to be clarified and better defined in regard to recycling. Current requirements for EIAs and EMPs for buyback centres are considered excessively onerous, time consuming and expensive, to the extent that entrepreneurs being discouraged to enter into this type of recycling venture.
- *Drop-off and buyback centres:* One of the problems currently experienced with these centres is that large distances often separate the drop-off facilities for the different materials, which is resulting in the system not being user friendly for the public and businesses which participate in voluntary recycling.

3.8 Framework for Waste Recycling

In order to fast-track the recycling component of the National Waste Management Strategy (NWMS), *Starter Documents* were compiled as part of the Department of Environmental Affairs and Tourism (DEAT) NWMS Implementation Programme (DEAT, 2000a). Recycling initiatives at an international and national level were investigated with the following outputs:

- *Background Document on Post Consumer Recycling in South Africa and Internationally* (DEAT, 2000c): A review of recycling initiatives and related policy measures that have been implemented in South Africa and internationally, with an assessment of the reasons for the relative success and/or failure of these initiatives. The constraints to recycling, the issues that require further investigation and the role of different stakeholders was identified (see section 2 above);
- *A Framework for Sustainable Post-Consumer Waste Recycling in South Africa* (DEAT, 2000c): An outline of the proposed mechanism for implementing sustainable recycling in South Africa;
- *A Legal Framework for Recycling* (DEAT, 2000d): A legislative framework that would support recycling.

The Framework Document (DEAT, 2000c) stated that in South Africa the main objectives for promoting and expanding recycling initiatives included the following:

- Job creation;
- Reduction of pollution and the conservation of natural resources;
- Conservation of energy and reduction of costs in manufacturing sectors;
- Litter abatement;
- Reduction of the waste stream itself;
- A reduction of scavenging on landfill sites.

In order to realise these objectives reliance on free-market forces alone will not be sufficient and additional forms of government intervention will be required. The Framework Document (DEAT 2000b) proposed the following approach:

- **Priority Waste Streams:** All components of the waste stream should be reviewed for the feasibility of recycling. In the short-term those initiatives currently ongoing should be further developed. In the medium and longer-term, other commodities should be identified and reviewed for the viability of recycling.
- **Implementation of Policy Instruments:** An appropriate set of policy instruments should be implemented with the aim of achieving the identified broader-based political and environmental priorities of recycling, i.e.
 - **Targets:** Realistic targets should be set for the levels of recycling that are socially, environmentally and economically optimised in full consultation with all stakeholders in the recycling chain. These should include targets for levels of recycling, as well as targets for reducing the quantity of domestic waste disposed at landfill sites by local government. Key issues that need to be addressed include:
 - The potential market for the recyclables and possible innovative developments for their end use
 - Technology currently available for recycling material;
 - Raw material costs;
 - The promotion of separation at source to recover cleaner material with a higher value;
 - Design of commodity and suitability for recycling;

- Environmental impacts through the life cycle of the recycling chain for the particular commodity;
- Education and capacity building and public awareness about the benefits of recycling.

Consideration should be given to establishing a Recycling Forum comprising representatives of all stakeholders. This Forum should be the mechanism by which targets would be negotiated. Guidelines to be used for implementing the targets should include the cost of collection and handling, recyclability, the life cycle analysis, market economic analysis and job creation. The onus for developing business plans for meeting the target should be on the industrial sectoral organisations. Local and provincial government should be required to address the attainment of waste reduction targets within their Integrated Waste Management Plans.

- *Government Procurement Policy:* As a demonstration of its commitment to promote recycling, government departments should amend their procurement policy to include specifications for recycled content for products they purchase and hence help to create a stronger market for recycled products. Steps should also be taken to ensure that waste generated on government departments, especially paper, is recycled.
- *Registration of Recyclers:* The DEAT is currently in the process of developing a Waste Information System (WIS) database. Eventually all waste disposers, treatment facilities and recyclers will be required to register with the WIS. There will be a phased implementation of the WIS, with a focus on 2 or 3 priority recycling waste streams in the first phase development of the WIS.
- *Market-based Instruments:* A number of economic instruments can be used as incentives for recycling or to provide funding to implement recycling initiatives, including for example landfill charges and raw material charges. Assessing the benefits of the implementation of these instruments is complex and will require a full evaluation of the social, environmental and economic costs. Commodity producers should be afforded the opportunity to make motivated proposals for the use of market-based instruments in their business plans submitted to government.
- *Awareness/Information/Education Initiatives:* National government, in consultation and partnership with provincial and local government, should facilitate education, capacity building and public awareness programmes. DEAT should identify and disseminate information available for the initiatives currently ongoing through for example, the internet and publications, as part of their ongoing awareness programme. The South African Waste Information Centre (SAWIC) will play an important role in raising awareness regarding recycling and disseminating information to the public, industry and the three spheres of government.

4 Waste Stream Identification and Characterisation

4.1 Overview of Waste Generation in South Africa

Waste is an inevitable consequence of development; and hence it must be managed in an integrated and sustainable manner (DWAF, 2001a). As the population increases and development takes place, a concomitant increase in waste generation is expected. There are a number of problems associated with increased waste generation, i.e. additional risk of air, soil and water pollution, and lack of suitable locations for landfill sites. In order to prolong the life of current landfills and optimally manage new landfills, the waste disposed to landfill sites has to be minimised. The vision of the Polokwane Declaration (DEAT, 2001) is to reduce waste generation to 50% of current levels by 2012 and to zero waste by 2022.

In order to manage waste in a sustainable manner, waste management must consider the waste stream in a holistic manner, in order to optimise the use of resources and to reduce the environmental impacts (Novella, 2000). Thus an integrated approach which combines a number of techniques such as waste reduction, reuse and recycling has to be considered. The National Waste Management Strategy defines a waste management hierarchy, which is based on the above-mentioned principles (see Figure 1). One of the mechanisms to resolve this problem is to identify what portions of the waste stream can most readily be minimised and / or recycled. To do this effectively, a quantitative understanding of the total waste stream is necessary. Aspects that will need to be addressed include the identification of the waste stream sources and an assessment of the waste stream composition, as well as the quantification of the main waste streams for each of these sources. Certain waste streams could be targeted for recycling, e.g. the high income domestic streams due to their high content of packaging material, and those streams that are not suitable for recycling, e.g. from low income domestic streams due to high ash and sand content.

The Department of Water Affairs and Forestry has developed an overall waste generation profile for each of the provinces (DWAF, 2001a), which gives a first order assessment of waste generation in South Africa (see Table 2). There is clearly a need for accurate up to date data on waste generation and waste disposal to landfills. This need has been articulated in the National Waste Management Strategy and the Action Plans for a Waste Information System (WIS) and Integrated Waste Management Planning (IW&MP). It was proposed that local authorities collect and report, *inter alia* waste generation rates, waste categorisation and identification waste streams that have potential for recycling. It is recognised that there will be practical constraints, e.g.

- the unavailability of weighbridges on most medium, small and communal landfills;
- The security risk around attempts to provide weighbridges at facilities that do not have 24hour 7 days/week armed security; and
- The financial implications of providing, maintaining and protecting the weighbridges.

Table 2: Waste received at landfill sites in South Africa (DWAF, 2001a)

Province	Waste Received at Landfil
	t/annum
Eastern Cape	571,000
Free State	782,000
Gauteng	4,297,000
KwaZulu Natal	1,811,000
Mpumulanga	481,000
Northern Cape	262,000
Northern Province (Limpopo)	153,000
North West	354,000
Western Cape	1,487,000
TOTAL	10,198,000

It was proposed that a first round of Integrated Waste Management Plans (IWMPs) should be prepared by 2004. However, since this was not a legislated requirement, few local authorities have as yet completed their IWMPs (DEAT, 2005a). Nonetheless, major metros such as Johannesburg, Cape Town, Ethekwini, and Tshwane, as well as a number of other cities and towns have initiated the process of compiling IWMPs, and the required information should become available over the next few years. .

4.2 Characterisation of the National Waste Stream

The data presented in section 4.1 provides an overview of the quantities of domestic and commercial waste generation in South Africa (based on information from waste disposed of at municipal landfills), on a province by province basis. However, for effective planning of recycling initiatives a more detailed breakdown or characterisation of the waste stream is necessary, i.e. to a level of individual types of recyclables or at least groups of recyclables. This information is crucial in order to meaningfully plan initiatives to stimulate and promote recycling at a national, provincial and local level. Unfortunately, there is only very limited recent information available at the national level on the quantities of the individual recyclables making up the national waste stream. In addition, it can be expected that the waste stream composition will be different for waste from different sources.

Because of the limited information which is readily available on recyclables in the waste stream disposed of at municipal landfills, an alternative approach has been taken in this study. Readily available information on specific recyclables was assessed by reviewing information from recycling companies and institutions who are directly involved in recycling and reusing commodities which normally end-up in the domestic and commercial waste streams and which are disposed to municipal landfill sites. The next two sections deal with the outcome of this review.

4.3 Generation Rates for Specific Recyclables

For the purposes of this report the approach to waste categorisation followed that used by the NWMS (DEAT, 1999), i.e. waste has been categorised as either general or hazardous. *General waste* is subdivided into paper/cardboard, metals, glass, plastics, organics and inert materials (including builders' rubble). Due to its composition and characteristics general waste does not pose a significant threat to public health or the environment, if managed properly. *Hazardous waste* is waste that has the potential, even in low concentrations, to have a significant adverse effect on the public health and the environment. It is categorised according to the nine classes and four hazardous ratings, as described in the DWAF Minimum Requirements documents (DWAF, 1998), which in turn follows SANS Code 10228:2003 – “*The Identification and Classification of Dangerous Goods for Transport*” (SANS, 2003). The nine classes are: Explosives (Class 1); Gases (Class 2); Flammable liquids (Class 3); Flammable solids/substances (Class 4); Oxidising Substances (Class 5); Poisonous and Infectious Substances (Class 6); Radioactive Substances (Class 7); Corrosive Substances (Class 8); and Miscellaneous Substances (Class 9).

An overview of the generation and recycling rate of specific recyclable commodities is presented below, to serve as a basis for prioritising these waste streams for recycling.

4.3.1 Paper

Paper and fibre recycling is well developed in southern Africa, with four large paper companies (Sappi, Mondi, Nampak and Swazi Paper) utilising waste paper products (DEAT, 2000c). Agents receive collected paper products, which are sorted into the different grades of paper. This is then baled and transported to the appropriate factories for recycling. Although agents are in some instances considered to be an unnecessary addition to the recycling chain, which results in less of the money paid for the recyclable material reaching the people actually doing the small scale waste segregation and collection, the sheer number of small scale collectors make it impossible for the recycling companies to deal with individual collectors. In addition, the agents are often providing the only means of transport for the recyclables from the point of collection to the recycling/treatment plant.

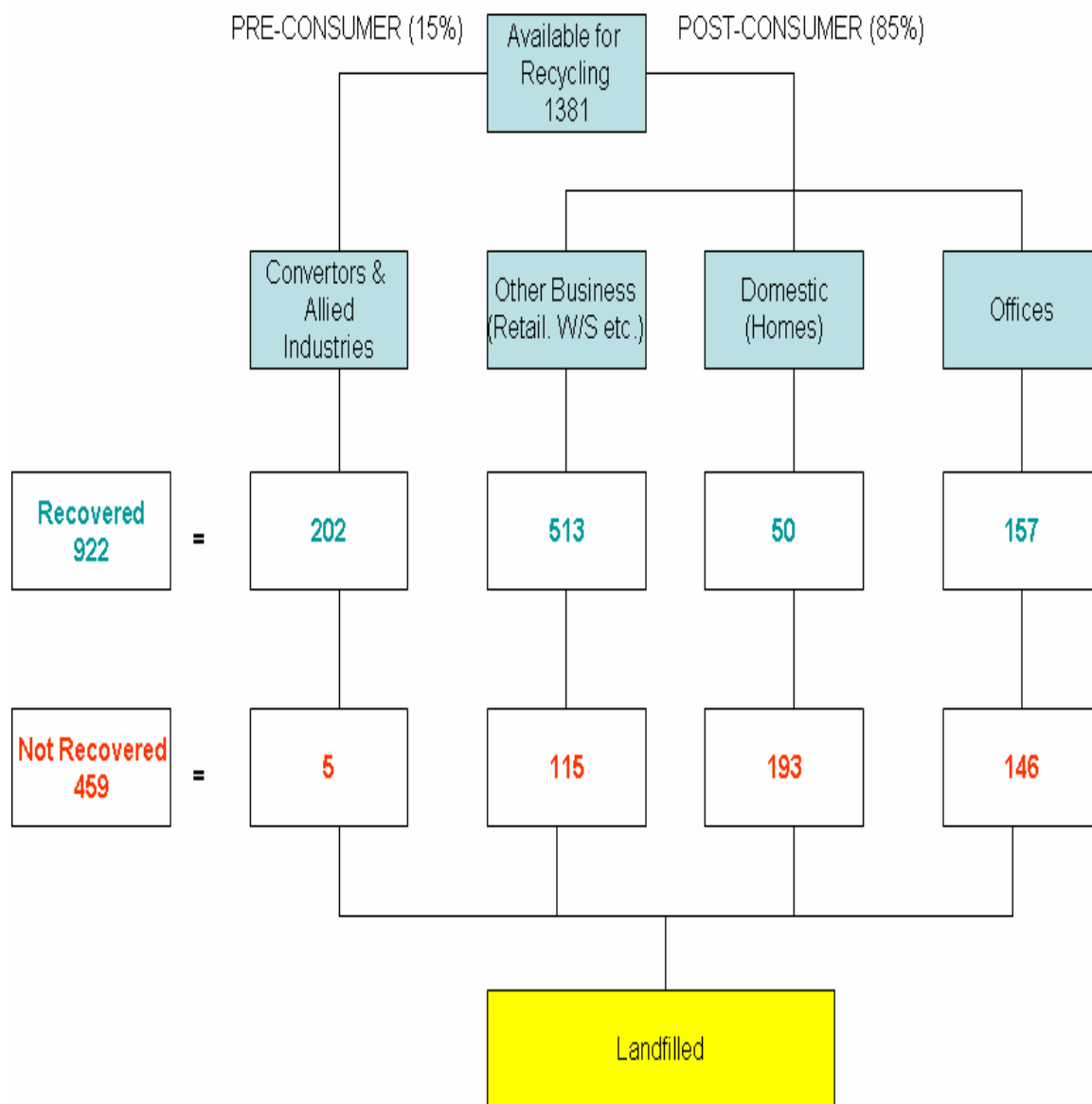
Large quantities of paper are being recycled in southern Africa, e.g. DEAT reported that the paper industry recycled 720,000 tonnes per annum in 1999 (DEAT, 2000c); some 818,000 tonnes per annum were recycled in 2001 (DWAF, 2001), and 922 000 tonnes of paper were recycled in 2003 (SAPPI,

2004) which represents a recovery of 52% based on paper generation. Figure 2 provides a breakdown of the various paper waste streams (SAPPI, 2004). Almost every type of paper produced in South Africa contains recycled material, e.g. newspaper contains 25% recycled paper, cardboard boxes 50% and cartons 100%. Toilet paper and tissue paper contain high percentages of recycled paper fibres.

Depending on the demand and supply situation, waste paper may be imported to supplement local waste paper. The reasons may include either a lack of local waste paper (as was the case in for example 1996), or a glut of cheap waste paper on the world market (as is currently the case). This is problematic for the local market and will require further investigation and possibly legislative control to protect the local market.

Current Recycling Trends

Figure 2 demonstrates that a large proportion of the waste paper in the stream from converters and allied industries is already being recycled. Retail businesses are also recycling significant volumes of paper. There is, however, still significant opportunity for recycling paper from offices as well as from private households.



Challenges

According to SAPPI (2004), the following major challenges face the paper recycling industry:

- There is an oversupply on all grades paper (i.e. diminished markets for the recycled products);
- Prices have consequently decreased;
- Competition is increasing;
- Importation opportunities have increased because of the strong Rand; and similarly export has diminished also as of the strong Rand.
- Customers have a wide range of suppliers; and
- Customers are tightening up on specifications.

Opportunities

Some of the key opportunities for paper recycling include (SAPPI, 2004):

- An increased demand for high grade waste paper;
- Pricing should remain static for the next 12 to 24 months;
- Pricing on lower grade wastes will drop;
- Supply will not slow down should the government's job creation programme become effective as if one collector closes, another will open.
- Sustainable market for recycled materials could be created though government policies for the procurement of recycled products.

4.3.2 Metals

Metal recovery falls into two main categories, i.e. beverage cans and scrap metal.

Beverage cans

In South Africa the major beverage can recovery group is Collect-a-Can, who established in 1976 as a joint initiative between Iscor, Metal Box and Crown Cork in order to recover steel beverage cans for recycling. Collect-a-Can is a non-profit company, established with the objective of pre-empting pending environmental legislation that could have resulted in cost implications for manufacturers of non-returnable packaging. The company has been proactive in the recycling field and has been promoting the recovery of beverage cans. To ensure the success of the recovery of beverage cans, Collect-a-Can subsidises the collection system. A variable rate is paid for each tonne of material that is delivered to either the depot or the steel mill. The unit price paid is dependent on the quality of the cans (DEAT, 2000c). In order to stabilise the market the price is fixed for about 18 months at a time. This mechanism of stabilising the market price has been very successful for beverage cans, but has only been possible because of the limited number of players in this market (i.e. Collect-a-Can, NAMPAK and ISCOR, who jointly support the initiative), whereas in other commodities (paper, glass and plastics) there is more extensive competition.

Collect-a-Can's recovery rate for all the steel beverage cans sold in southern Africa has grown from 18% in 1992 to 63% in the 1998/99 fiscal year (DEAT, 2000c), and 66 % in 2004 (DEAT, 2005a). The recovery and recycling rate for South Africa is estimated between 80 and 90% for 2004 (DEAT, 2005a). In terms of quoted international recovery rates, the region now ranks in the top five in the world. Collectors often form their own collection networks and deliver their cans directly to the recycling centre or steel mill. The tin-bearing scrap is electro-chemically processed to recover the pure tin, tin oxide, and high-grade steel scrap. The tin is sold for manufacturing new tinsplate and the steel is also sold for re-smelting and re-use. The tonnage of tinsplate produced in 1997 was 302,857 tonnes, with an additional 13,625 imported. The total converted into packaging was 275,000 tonnes. The tonnage recycled was 129,000 tonnes of which 61,000 tonnes was from steel beverage cans.

The number of registered collectors has increased from 1,500 in 1992 to over 37,000 in 1999. An analysis of the collectors in May 1999 showed that more than 80% of them would otherwise have been unemployed with no alternative source of income. To date six recovery centres have been established in South Africa.

Scrap metal

Scrap metal is typically recovered by companies and individuals and sold to scrap metal dealers. A company such as the Reclamation Group recovers approximately 3,000,000 tonnes per annum of ferrous metals and 93,000 tonnes per annum of non-ferrous metal. Because of the relatively high prices paid for scrap metal, this is a lucrative area for recycling and this sub-sector of the recycling industry has experienced a high incidence of trading stolen materials. For example, the two major utility parastatals in South Africa, Telkom and Eskom, spend millions of rands annually replacing (and trying to curb the theft of) copper wire and heavy plastic casing for their cables and fibre. In addition to the financial considerations, the 'salvagers' put their lives at risk when attempting to steal live electrical cables.

Other metal item stolen and sold as scrap include cast iron manhole covers and aluminium barriers on bridges, creating safety risks for the public. Tyres are burnt at night (when the smoke is less visible) to reclaim the steel belt from tyres for recycling.

Current Recycling Trends

The steel beverage can has become one of the most popular and versatile packaging formats in southern Africa, with over 3 billion cans (for beer, soft drinks, cider, fruit juices and other beverages) being consumed annually. The leading steel companies (such as Iscor) believe that steel cans have both short- and long-term business benefits. As a local resource, steel is readily available and its price is more stable than other packaging materials, making operating costs more predictable (DEAT, 2000c). There is also a trend of increased use of PET bottles for beverages (and many other food products), which may affect the use metal cans in the future.

Challenges

No pre-treatment is required for cans to be recycled. Steel scrap is an integral part of steel production and it is estimated that at any one time, 48,000 tonnes of scrap is melted in the world to produce prime steel. However, steel manufacturers need to take due precautions to ensure that using scrap steel does not detrimentally affect the quality of the resultant product.

Opportunities

This is one of few commodities within the recycling industry that has seen price stability over the years, through the control mechanism described above. The price stability for cans may be attributed to the fact that Collect-a-Can is a non-profit organisation (set up by the can manufacturers, ISCOR and NAMPAK), an efficient and well controlled collection network, with a minimum of collection agents. Collectors are paid higher prices than the reigning steel price financial incentives are offered for collectors to deliver to Collect-a-Can branches and where practical, cans are collected from collectors' location of storage.

In summary, the recovery of metal is well entrenched with major successes in the recycling of beverage cans and scrap steel.

4.3.3 Glass

The Glass Recycling Association was formed in 1986 by Consol Glass and Metal Box Glass with the objective of developing an industry approach to the recovery of glass containers from a wide spectrum of the domestic and industrial sectors. Glass is collected for recycling, as cullet (crushed glass), broken glass or as whole bottles, which may be cleaned and reused. Collection is via collection depots (bottle banks) or containers (igloos) at individual businesses, as well as from landfill sites.

Collection of glass has grown from 54,370 tonnes in 1986 to 104,550 tonnes in 1999 (DEAT, 2000c). The total tonnage of glass packaging produced in 1999 was 520,500 tonnes of which 104,550 tonnes was recycled. The tonnage converted into reusable containers was 110,000 tonnes. The recycled glass packaging was sourced as follows:

• Bottlers	38,000 tonnes
• Bottle banks	31,500 tonnes
• On premise consumption outlets	18,250 tonnes
• Informal trade (hawkers)	7,250 tonnes
• Neighbouring states	5,500 tonnes
• Schools and charities	4,050 tonnes

The tonnage collected in the form of returnable bottles was 32,130 tonnes in 1999. These bottles were recovered from users such as SAB and Coca Cola, and were bottles that have reached the end of their useful life. This tonnage is particularly high due to the change over from 1 litre soft drink bottles to the 1.25 litre size. Approximately 8,000 tonnes of the old 1 litre size bottles were culled.

The maximum amount of cullet that can be recycled at the current levels of production is 175,000 tonnes. Alternative markets are continuously being explored and waste glass has successfully been used in the manufacture of abrasives, road-marking paints and ceramics.

Recycling Trends

Generally the glass recycling business is well established in South Africa. In 2002, 143 agents throughout South Africa collected glass. Glass needs to be separated into the three primary colours, flint (clear), amber and green. The flint glass is the most valuable and green the least (Beningfield, 2002).

Challenges

The following challenges to glass recycling have been identified (Beningfield, 2002):

- Risks (e.g. price fluctuations) are borne by the collector;
- If the glass is contaminated either by different coloured glass or by items such as ceramics, the whole load is rejected;
- Glass recycling is a volume business and margins are tight. To cover R1.00 in overheads, 25 post producer or 47 post consumer bottles need to be collected.

A further major challenge for the waste glass industry is that reusable bottles are being phased out and replaced by various disposable containers (cans and plastic bottles). The main reasons for this change are cost and convenience, the reusable container is seen as a nuisance by both the public as well as the stores that need to administer the return of such containers. Re-introduced of reusable glass bottles into the market in a sustainable manner should be considered.

Opportunities

The post consumer business (restaurants, bars etc) has grown significantly. The challenge will be to educate and provide these post consumers with suitable infrastructure to enter the waste recycling process.

4.3.4 Plastics

There are approximately 100 companies recycling plastics in South Africa (DEAT 2000c). Under the auspices of the Plastics Federation, the Plastics Enviromark initiative was launched in January 1997. This initiative aims to:

- Join the companies within the plastics industry in an environmental responsibility initiative.
- Provide a tangible expression of the plastics industry's commitment to environmental responsibility.
- Highlight, and as far as possible, address the problem of plastic littering.
- Educate relevant target audiences on recycling and reuse.
- Spread a positive message about plastics through the media, at exhibitions and through the dissemination of educational material.

Raw material suppliers and plastic converters who contract to support the programme are allowed to use the Enviromark logo on their stationery and products. A licensing fee, based on the tonnage converted, is payable to the Plastic Federation to fund various environmentally orientated projects. Approximately 80% of the plastic packaging industries are currently contributing to this programme.

There are more than 60 different types of plastic resins and the Plastic Federation of South Africa has adopted a voluntary coding system for each category to aid in their sorting by material type for recycling. The most common resin types are:

- PET (polyethylene terephthalate);
- HDPE (high density polyethylene);
- PVC (polyvinyl chloride);
- LDPE (low density polyethylene);
- PP (polypropylene);
- PS (polystyrene).

The total tonnage of virgin plastics produced in 1997 was 905,000 tonnes, of which 445,000 tonnes was converted into packaging. The tonnage of plastics recycled, including non-packaging items, was 115,000 tonnes (13%), which places South Africa in the forefront of plastics recycling worldwide.

Recycling Trends

The recycling of plastics is very well established, with the Plastics Federation taking a lead role. Although the industry is buoyant, it is sensitive to price changes (Steyn and Dlamini, 2000). This applies to both the prices paid for recyclate and the price of virgin materials. However, rising labour and services costs are forcing recyclers to become more selective regarding the quality and type of materials being recycled.

Challenges

As plastic recycling costs mount, there is a danger that portions of the potential market are not recycled because of inferior quality. This stream would then report to landfill or illegal burning where landfills are not readily available, or to avoid the disposal costs at landfills.

PET bottles pose a major challenge in terms of: the quality retrieved at landfills; poor utilisation of landfill air space, and logistical problems with the PET bottles occupying a large volume but having a low mass and value (21 PET bottles need to be collected to raise R1.50, Beningfield, 2002) and the high cost associated with transporting a voluminous material. The transport problem could possibly be overcome by bailing at source.

Opportunities

Opportunities in the plastic recycling market may be better focused at the manufacturing level. Coca-Cola for example, has designed their bottle to be easily recycled since the label, glue and lid are easily removed (Beningfield, 2000). The challenge and potential of re-introducing the returnable glass bottle as an alternative to the plastic beverage container also needs to be explored.

4.3.5 Tyres

According to a feasibility study undertaken for the South African Tyre Manufacturing Conference (SATMC, 1998), 160,000 tonnes of scrap tyres are generated in South Africa each year. More than 28 million used tyres are dumped illegally or burnt to recover the steel wire annually, which is sold as scrap metal, a figure that is thought to increase by 9,3 million annually. Tyres are not readily accepted at landfill disposal sites as they are not easily compacted due to their elasticity and occupy a considerable volume. Furthermore, tyres have the tendency to accumulate water, irrespective of the way in which is stored out in the open and become breeding environment for mosquitoes, which is particularly problematic in areas of the country where malaria occurs.

Recycling Trends

Recent agreements between the tyre manufacturing industry and the Department of Environment Affairs and Tourism have led to initiatives to generate a 'green fee' which will be used to initiate tyre recovery, recycling, energy recovery and disposal.

Challenges

The primary challenge will be to recover the estimated 28 million tyres that are dumped illegally every year. A further challenge is the management and control of worn casings, i.e. casings are worn down to the point where they are no longer suitable for re-treading and tyre casings (which is in effect a waste) have to be imported to serve that market.

In addition, worn tyres create a safety risk and better law enforcement will not only decrease the risk of fatal road accidents, but it will also prevent the need for tyre casings to be imported as the tyres will be removed from the vehicles at a time when they are still suitable for use as re-treaded tyres. The concerns raised about the significant cost of fatal road accidents to the country, together with the environmental damage resulting from South Africa importing tyre casings ("waste"), should justify an increased initiative to ensure effective law enforcement in terms of tyre life.

Opportunities

The most significant opportunity will be to recovery all the products from the used tyres and to identify markets for re-use. Once this happens, used tyres will have an intrinsic value and thus will be items for both formal and informal collection.

4.3.6 Organics

Currently, only relatively small quantities of organic waste are processed for use as compost. Small-scale composting is practised, but large scale composting of organic waste from households, commerce and industry is rare. There appear to be retail markets available for high quality compost, and a potential for municipal use of compost at sports facilities and public parks.

According to the City of Johannesburg, on average in excess of 30% of the waste stream is compostable which amounts to up to 2,840,000 tonnes/annum of potentially compostable material. Other municipalities have also reported high percentages of garden greens (up to 20 % by mass) being disposed of to landfills, e.g. for the towns of Rustenburg and Stellenbosch (see Appendix 1).

Processing Trends

Composting offers a potential lucrative market for putrescible organic and garden waste. A reduction of 30% in the waste stream would he significant impacts on the volumes of material reporting to landfill.

Challenges

Some of the challenges to composting include (Eichstadt, 2002):

- Availability of processing facilities;
- Environmental impacts;
- Cost efficient collection and processing; and
- Market availability.

Opportunities

Municipalities need to explore the opportunity to significantly reduce / divert (20-35%) the waste load of garden / park greens from their landfill sites to commercial use by exploring composting. This would address their disposal needs for greens from private and municipal gardens, as well as serving as a source of high quality compost which they may currently be purchasing at high cost for municipal parks and gardens.

Other opportunities in the processing of organics include energy recovery methane gas from landfills and the use of organics as alternative fuels, e.g. the use of waste tyres as an energy source in cement kilns.

4.3.7 Inerts

Building rubble, i.e. waste from the demolition of buildings (e.g. houses, offices and commercial and manufacturing facilities), usually contains a high proportion of concrete, reinforcing, bricks, masonry and asphalt. The relative proportion will depend on the type of demolition activity (Macozoma, 2000). This material can be reused or processed to be used as fill and cover material at landfill disposal sites

and building sites. Crushed building rubble has a number of useful applications, e.g. as a raw material for manufacture of bricks (as undertaken by Skip Waste in the south of Johannesburg).

Recycling Trends

Some landfill sites report high loads of building rubble being disposed of to their landfills, e.g. at the Simmer and Jack landfill in Ekurhuleni, building rubble makes up about 23% (on a mass basis) of the waste disposed off to this landfill. This high percentage may be attributed to the fact that no charge is levied on the disposal of building rubble at this landfill. Conversely, at the City of Johannesburg landfills only about 4 % of the waste stream reporting to landfill is made up of building rubble. It is suspected that this percentage is small because Johannesburg charges for building rubble disposal. A negative impact of this approach is that significant quantities of the building rubble are illegally dumped. The opportunity however does exist to examine options for recovery and recycling as input material to alternate building materials and processes. Local initiatives in this regard are being investigated by the Gauteng Economic Development Agency.

Challenges

Challenges to rubble recovery include (Macozoma, 2000):

- Strict and conventional construction standards and specifications;
- Market constraints and competition for raw/virgin materials;
- Competition with landfill sites for rubble used for daily cover and used to construct site roads;
- Capital costs for recycling operations; and
- Public perceptions to secondary materials.

Opportunities

Opportunities for rubble recycling include (Macozoma, 2000):

- Limited natural resources, although readily available in the short term;
- Scarcity of land for development of landfills;
- The combating of illegal dumping with its adverse aesthetic environmental implications.
- Rubble remains a virtually untapped resource in South Africa at present; and
- Follow international trends in rubble recycling, e.g. in Europe and other developed countries landfill space is virtually non-existent (or extremely expensive) and virgin materials for construction is also a scarce and expensive commodity, thereby justifying the significantly higher costs associated with the use of recycled building rubble in these countries.

4.3.8 Other Commodities and Waste Streams

In a DEAT study on Product Stewardship and Extended Producer Responsibility (EPR) undertaken in 2002 (DEAT, 2002) it was proposed that the following commodities / products / waste streams be given priority for further consideration and investigation:

- *Electronics:* CRT's, CPUs, VCRs and cell phones; E-waste initiative;
- *Products containing mercury:* Thermometers, thermostats, electrical switches (including automotive), Fluorescent lamps, Button cell batteries; Products with trace mercury (e.g. soaps, cleaners, shampoos);
- *Pesticides:* Household, commercial / institutional and agricultural;
- *Paint and paint products:* Latex, oil based paints and thinners;
- *Other products/materials:* Tyres, carpets, packaging (e.g. plastics), beverage containers, batteries, appliances, furniture and food wastes.

These products are readily available in South Africa either as local products or as imported goods. The challenge will be to prioritise implementation of Product Stewardship and Extended Producer Responsibility (EPR) for these products, based on criteria such as the risk they pose to the safety, health and the environment and the implications of implementing PS and EPR.

EPR is dealt with more extensively in a separate report, i.e. *Extended Producer Responsibility: Status Quo Report* (DEAT, 2004b) and deals with the various issues (e.g. appropriateness and economic viability) that need to be carefully considered prior to embarking on a programme of EPR.

4.4 Current Recycling Initiatives

In order to promote and enable sustainable recycling as a means to minimise and reduce waste, all stakeholders in the complete recycling chain need to be appropriately involved. These stakeholders comprise the following groupings:

- Waste generators (e.g. households, retailers, business and industries, service sector);
- Waste collectors and reclaimers (e.g. municipalities, private waste management service providers, SMEs and informal sector);
- Waste brokers / agents – i.e. entrepreneurs who buy and sell recyclable materials;
- Waste converters and recyclers – who buy recyclable material and alter it into a form that is readily useable by a manufacturer, e.g. recycled plastic pellets to be used by plastic extruders, compost using composting plants; etc.
- End-use markets – consumers (the public) and businesses who purchase recovered/converted materials to make new feedstock;
- Waste disposal entities - who dispose of waste residues remaining after the recyclables / compostables have been removed, e.g. private sector and municipalities;
- Policy makers (e.g. the 3 spheres of government);
- NGOs, Community and Consumer Groups;
- Research Institutions.

In order for recycling to become successful stakeholders need to be made aware of the crucial need for and the environmental benefits of sustainable recycling. Businesses throughout the recovery chain need to realise inherent value in recyclable material, as well as the impact of waste on the environment. Individuals need to realise that responsible management of recyclable materials in all facets of their daily lives will ultimately affect the standard of living of their children.

To accomplish this, the National Waste Management Strategy advocates the development of public/private initiatives that can drive forward the process of waste reduction. Furthermore, the Polokwane Declaration has set very challenging targets, i.e. 50% reduction in waste to landfill by 2012 and zero waste by the year 2022. These are targets will have to be reviewed in the light of detailed planning through the integrated waste management plans (IWMPs) being developed by local authorities and industries, and will have to take into account the priorities and realities facing local government and industries.

This is the enabling environment which allows private/public initiatives to be developed. Many recycling initiatives are currently on-going in South Africa, i.e. many of these have been identified through the Provincial Recycling Workshop (DEAT, 2005a). In addition, the National DEAT has initiated initiatives to stimulate recycling for three priority waste streams, i.e. in the plastics, glass and tyre sectors. These initiatives have been formalised through various voluntary instruments, Memoranda of Understanding and Memoranda of Agreement, which are briefly discussed below.

4.4.1 Memorandum of Understanding on Plastic Bags

During May 2002 DEAT and the key stakeholders in the plastics sector, i.e. Organised Labour (The Congress of South Africa Trade Unions and National Council of Trade Unions) and Organised Business (Chemical and Allied Industries Association, Plastics Federation Of South Africa, Plastic Recyclers Employers Organisation, and The Retailers Plastic Bag Working Group) entered into a Memorandum of Understanding with the following aims:

- Addressing the problem of dispersed waste (i.e. litter) created by discarded plastic bags in South Africa and encouraging the re-use and recycling of plastic bags. There is a need to address environmental issues, including dispersed waste, in a sustainable manner;
- Adopting an approach for addressing the negative impacts associated with the generation, use, collection, transportation and disposal of plastic bags which will optimise the impacts of the DEAT's regulatory efforts whilst minimising any negative social or economic impacts, especially those relating to workers, the poor, women and rural areas.
- Commitment to taking a co-operative approach towards addressing environmental problems that face South Africa and furthermore reflects the spirit of collaborative partnerships.
- Commitment to a partnership approach to the achievement of sustainable development, which includes social, economic and environmental goals. Sustainable development promotes environmental justice which integrates environmental considerations with social, political and economic justice and development in addressing the needs of all communities, sectors and individuals.

The MOU was signed on 26 September 2002, soon after the World Summit on Sustainable Development, which was held in Johannesburg and built on the spirit of sustainable development enshrined in the Johannesburg Plan of Implementation, and the parties committed themselves to the successful implementation of this, the first ground breaking partnership, which has been established since the Summit. The MOU made provision for the implementation of the Regulations and establishment of a Section 21 company to take the initiative forward. The Plastic Bags Regulations were promulgated by Government in 2003, aims to reduce the number of plastic shopping bags that are discarded in the waste stream, often landing up as unsightly wind-blown litter. The Regulations limit the thickness of the plastic bags, the type of ink used in printing and proposes the tariffs for purchasing of the bags. The intention is to turn the plastic bag into a value product that is recovered and recycled.

Many practical problems were encountered in getting this initiative off the ground, but the Section 21 company, Buyisa-e-Bag, has been recently (2004) registered and has started functioning. The DEAT is engaging relevant stakeholders to ensure that the terms of MOU, such as establishment of standards, are adhered to.

4.4.2 Memorandum of Understanding on Glass

A Memorandum of Understanding has been jointly developed between the Department of Environment Affairs and Tourism (DEAT) and the key stakeholders in the Glass sector (The Glass Manufacturers, the Users, the Recyclers and Collectors, the Processing Sector, Organised Labour, Consumer Organisations, and the Consumer Goods Council of South Africa). The net effect of the MOU is to put into place an industry wide structure that will facilitate a process to achieve the following specific objectives:

- To promote the reuse and recycling of glass containers in South Africa in order to minimise waste of glass, facilitate environmental awareness in regard to these issues and effect sustainable environmental improvements;

- To put in place an industry wide structure which will facilitate a substantial increase in the collection, recycling and/or reuse of used glass in the industry;
- To increase the amounts of jobs in both the informal and formal sectors of the South African economy, more particularly in the glass industry as regards the collection, recycling and re-use of glass containers;
- To commit the Parties to job creation in these sectors taking into account the objectives of transformation and employment equity, the establishment of buy-back centres and the transfer of skills to previously disadvantaged individuals; and
- The Parties will endeavour to ensure that no exploitation of workers occurs in the glass industry as regards to the collection, recycling and re-use of glass containers.
- The MOU makes provision for a structure (a Section 21 company) to implement the objectives of the MOU, for the setting of targets, for the establishment of a task team, and defines the roles and responsibilities of all the Parties to the MOU.

The glass MOU has been redrafted to address the concerns of the Competition Commission and there is a strong commitment both on the side of Government and the industry to have the redrafted MOU signed by April 2005. A task team has been established to prepare for the launch of the MOU.

4.4.3 Memorandum of Agreement on Waste Tyres

A Memorandum of Agreement (MOA) has been jointly developed between the Department of Environment Affairs and Tourism (DEAT) and the South African Tyre Recycling Process Company (representing the Tyre Suppliers and the Waste Tyre Users). The aim of the MOA is to promote the collection, recycling, reuse and reduction of waste tyres in South Africa and in particular to reduce the amount and volume of tyres littering the country. Certain aspects of the MOU are still being finalised and it is hoped to sign a final MOU in the near future.

Government has drafted a Tyre Regulation which is to be published in the near future for public comment. The tyre industry has registered a Section 21 company to manage the process, of which three key functional areas have been identified:

- Management of a sustainable collection process for waste tyres;
- Promotion of the expansion of the waste tyre industry; and
- Conducting of a public awareness and support programme in respect of environmentally sound disposal of waste types.

It is envisioned that financing for the company and the programme will be raised by way of a 'green fee'.

5 Prioritisation of Waste Streams

The NWMSI Project recycling team has been engaged in a process to identify potential priority waste stream in South Africa over the last six months. This process comprised three approaches, i.e.:

- A literature review of waste and waste recycling in South Africa;
- Interviews with stakeholders who are currently involved in recycling of waste commodities; and
- Consultation of stakeholders through a range of Provincial Recycling Workshops (DEAT, 2005a).

The potential priority waste streams identified are briefly listed and commented on in the Table 3

below. Using these identified potential priority waste streams the NWMSI Project Output 3.5 requires the recycling team to prioritise the waste streams and to identify:

- One waste stream/commodity which is currently being recycled and still hold significant potential for optimisation and increased recycling; and
- One waste stream/commodity which is currently not being recycled to a significant degree, but which holds significant potential for recycling.

Notwithstanding these project requirements, it is recognised that recycling is more cost-effective if a number of materials are separated and collected at the same time, than to have a process only for the collection of one material, and this has been taken into consideration in the further prioritisation of waste streams. In addition to the specific project objectives set out above, two further uses of the outcomes of this waste stream prioritisation study may be:

- to focus DEAT's efforts in terms of the development of recycling policies, incentives and future initiatives; and
- to use the identified priority waste streams as indicators of the success of recycling, through its Waste Information System (WIS), which is also being developed by the NWMSI Project.

In order to prioritise the identified waste streams for further pilot studies a set of prioritisation criteria were developed. The DEAT NWMS Starter Document for Waste Recycling (DEAT, 2000a) lists the following criteria for promoting and expanding recycling initiatives:

- Job creation;
- Reduction of pollution and the conservation of natural resources;
- Conservation of energy and reduction of costs in manufacturing sectors;
- Litter abatement;
- Reduction of the waste stream itself;
- A reduction in scavenging on landfills.

In addition to the afore-mentioned criteria the following technical and financial criteria were also considered (DEAT, 2005a and Scheinberg and IJgosse, Undated):

- Associated health and safety risk,
- Material value,
- Abundance in waste stream,
- Separability from waste stream,
- Bulking factor for landfill,
- Recycling options,
- Access to regular and reliable data on recycling of prioritised waste streams, and
- Existing recycling initiatives and programmes.

Finally, successful recycling initiatives (including pilot studies) require four key elements to be in place:

- The buy-in and participation by the key stakeholders that are affected by or may impact in the initiative (e.g. separation at source, delivery to drop-off centres and buy in from workers);
- The availability/proper design/operation and maintenance of the logistical systems and

infrastructure required to receive / collect / transport the recyclables (e.g. igloos, buy back centres and agents with transport);

- The appropriate industries to process the recyclables that are recovered (e.g. recyclables and composting); and
- A market for the recycled products (e.g. recycled paper and compost).

All these elements need to be in place to ensure reasonable success for the recycling initiative. Should one or more not be in place or in doubt, great care should be exercised in deciding on the practical implementation of such an initiative.

The identified waste streams were prioritised using the above criteria and results of this process is present in the prioritisation matrix in Table 4 below.

The waste streams that scored high in terms of priority for pilot investigation were: tyres, electronic waste, building rubble, paper, glass, plastics, organics and scrap steel. A separate proposal has been developed for NWMSI Project recycling pilot projects and investigations to address these prioritised waste streams (DEAT, 2005b).

TABLE 3: Potential Priority Waste Streams

No.	Waste Streams / Recyclable Commodities	Comment
1	Beverage Cans	Current (2004) recycling rate 80-90 %
2	Used Oil	Current (2004) recycling rate 70%; Problems include waste oil dumping at landfill sites; Need for regulation of oil recycling industry; Some companies provide sub-standard service
3	Paper	Current (2004) recycling rate 52 %; Two potential waste streams that have not yet been sufficiently targeted for recovery and recycling, i.e. high quality waste paper from offices and households; High recycling potential through government procurement of recycled paper.
4	Glass	Current (2004) recycling rate 22%; Recovery in small towns is not economically viable due to high transportation cost; Government has entered into an MOU with Stakeholders; Various activities on-going to implement MOU undertakings
5	Tyres	Current (2004) recycling rate 15%; Government has entered into an MOA with Stakeholders; Various activities on-going to implement MOA undertakings; DEAT to publish Tyre Regulation in near future; Competition Commission has raised concerns about MOU; Investigation underway to produce fuel from waste tyres
6	Plastics	Current (2004) recycling rate 14%; Government has entered into an MOU with Stakeholders; Section 21 Company has been launched to promote and manage plastics recycling
7	Organic waste (e.g. garden greens; agricultural waste (fruit))	High percentage contribution to landfills (e.g. 10-35%); Composting of garden greens practiced in some municipalities, but still large potential scope;
8	Building rubble	High percentage contribution to landfills (e.g. 10-20%); Presents problems in terms of illegal dumping; Potentially valuable source of base course material for road construction; could possibly be linked the Dept of PW's Extended Public Works Programme
9	Electronic waste (e.g. PCs, VCRs, TVs, Batteries, Neon tubes)	Potentially hazardous; Industry initiative has been launched in SA, supported by Swiss Government; Industry needs to take control through EPR
10	Saw dust and wood shavings (e.g. from forest milling activities)	Problem waste in Mpumalanga and Kwa-Zulu Natal; Does not compost well, investigation underway to address problem
11	Used drums and other bulk containers	Recycling considered problematic, particularly for those containers used for storage of hazardous chemicals
12	Domestic and Industrial Ash	Major contributor to the waste load on municipal landfills; Currently limited use in brick making
13	Health Care Waste	Potentially infectious and hazardous; Being investigated as part of the HCRW Component of the NWMSI Project
14	Polystyrene packaging	Problematic at landfills
15	Disposable nappies	Problematic at landfills
16	Recyclables at landfills	Very widespread problem with salvagers on most general waste landfill sites in South Africa
17	Source separated recyclables	A number of source separation initiatives are currently being implemented in South Africa

TABLE 4: Waste Stream Prioritisation Matrix

Prioritisation Criteria		Waste Streams													
		Beverage Cans	Paper/Cardboard	Glass	Plastics	Tyres	Used Oil	Organics	Building Rubble	Electronic-waste	Scrap Steel	Saw Dust	Drums	Ash	HC-waste
1	Health & safety risk	0	0	1	0	0	1	0	0	2	0	0	1	0	2
2	Reduction in waste stream to landfill	0	0	0	0	1	0	2	2	0	0	0	0	1	0
3	Reduction in pollution & conservation of natural resources	0	0	0	1	1	2	0	1	2	0	0	1	1	2
4	Litter abatement	2	2	2	2	2	0	2	2	2	1	0	1	0	0
5	Job creation	2	2	2	2	2	2	2	2	2	2	1	2	1	2
6	Conservation of energy & reduction in cost in manufacturing sector	2	2	2	2	2	2	1	2	2	2	0	1	0	0
7	Reduction in scavenging on landfills	1	2	2	2	2	0	0	0	1	2	0	2	0	0
8	Material value	1	2	1	1	1	1	0	0	2	2	0	1	0	0
9	Existing & potential market	2	2	2	2	1	2	2	2	2	2	0	1	1	0
10	Abundance in waste stream	0	0	0	0	0	0	2	2	0	0	0	0	1	0
11	Separability from waste stream	1	2	2	2	2	0	2	2	2	2	1	2	1	1
12	Bulking factor for landfills	0	0	0	0	2	0	2	2	0	1	2	1	2	0
13	Recycling options	2	2	2	2	2	2	2	2	2	2	0	2	1	0
14	Access to regular & reliable data	1	1	1	1	1	1	0	0	0	0	0	1	0	0
15	Existing recycling initiatives, programmes & MOUs	2	2	2	2	2	2	1	1	2	2	0	0	0	2
Overall Score		16	19	19	19	21	15	18	20	21	18	4	16	9	9

Scoring System: Not Significant – 0; Possibly Significant – 1; Significant - 2

6 Conclusions

The status quo of recycling in South Africa has been reviewed and assessed. The report briefly presents an overview of waste generation in South Africa at a national level. Unfortunately, there is only limited information on the composition and nature of the waste stream disposed at landfills in terms of recyclables. Nonetheless, this information is currently being collected by local authorities (particularly the larger authorities) for the purposes of compiling their integrated waste management plans (IWMPs), and hence additional information may become available over next year.

The report has identified, reviewed and assessed the waste streams and commodities that are being recycled, the current levels of recycling, the mechanisms for waste collection and processing, and the drivers for and barriers against recycling. The potential for further recycling for each waste stream has been assessed. The results were used as a basis for identifying and selecting priority waste streams for further investigation for pilot studies under the NWMSI Project. The waste streams that scored high in terms of priority for pilot investigation were: tyres, electronic waste, building rubble, paper, glass, plastics, organics and scrap steel. A separate proposal has been developed for pilot projects and investigations to address some of these prioritised waste streams.

The provisional findings of this Waste Stream Prioritisation Study were tested and discussed with a wide range of stakeholders through a series of Provincial Recycling Workshops held during the period - October 2004 and January 2005. This report reflects the input and contributions made during these multi-stakeholder consultative workshops.

In addition to meeting the primary objectives of the study, i.e. to prioritise the waste streams for recycling, the outcomes may also prove useful for:

- Focusing the Department of Environmental Affairs and Tourism's efforts in terms of the development of recycling - policies, legislation, incentives and future initiatives; as well as
- Providing a practical basis for the NWMSI Project Waste Information System development team to use the identified priority waste streams as indicators of the success of recycling.

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APPENDIX 1: TYPICAL EXAMPLES OF WASTE STREAM COMPOSITION

Three typical examples of the composition of waste streams for different kinds of landfills are given below, i.e. for a Metro (Ekurhuleni), a medium sized municipality (Rustenburg) and a small farming town (Stellenbosch). It is clear from these examples that builders' rubble and garden waste are major contributors to the waste disposed of to these landfills.

1. Waste Stream Composition for the Simmer & Jack Waste Disposal Site

The operational report above illustrates the waste streams composition at the Simmer and Jack landfill. The above landfill takes in between 20 to 30 % Ekurhuleni's municipal waste. (Information supplied by Kutu Waste: Management Contractors on site).

CLASSIFICATION	Tons : Nov 04	Tons : Dec 04	Tons : Jan 05
Ash cover material	580	856	553
Compost	456	370	557
Clean building rubble	6,885 (23%)	5,667(22%)	6,396 (23%)
Concrete pipes	0.20		2.90
Domestic refuse - compacted	6,720	8,984	8,567
Garden refuse	151	120	273
Industrial refuse - compacted	8,952	7,424	8,701
Industrial refuse - Outside	491	480	607
Mixed rubble	1,394	818	722
Car Hulks	27	15	8.76
Soil cover material	3,508	1,045	1,320
Unsound foods	14	12	1.06
TOTAL	29,178	25,791	27,709

2. Waste Stream Composition for the Townlands Waste Disposal Site

The operational report below illustrates the waste stream composition for the Townlands landfill for January 2005. The above landfill takes in most of the Rustenburg municipality's waste. (Information supplied by Platinum Waste Resources: Management Contractors on site)

CLASSIFICATION	m ³	Density	Tonnes
1. General Waste	15,469	200	3,093.800
2. Garden Refuse	5,591	300	1,677.300 (22%)
3. Industrial Waste	883	400	353.200
4. Building Rubble	2,287	1,000	2,287.000 (30%)
5. Foodstuffs	225	650	146.250
TOTAL	24,455		7,557.550

3. Waste Stream Composition for the Stellenbosh Waste Disposal Site

The operational report below illustrates the waste stream composition for the Stellenbosch landfill. The above landfill takes in most of the municipality's waste. (Information supplied by Enviro-fill: Management Contractors on site)

CLASSIFICATION	Oct-04	Nov-04	Dec-04
1. General waste	7,069.00	11,187.00	9,374.00
2. Garden waste	774.00 (7%)	941.00 (6%)	2,790.00 (21%)
3. Cover received	3,253.00	2,847.00	1,135.00
TOTAL	11,096.00	14,975.00	13,299.00