**National Waste Information Baseline Report**

**Draft 6**

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| DISCLAMER:  The statements made and conclusions drawn in this report are based on the available documented data and research findings. No primary data collection was done. While every effort has been taken to verify the data, the Department of Environmental Affairs, CSIR and COWI can not be held accountable for the accuracy of the data on which the conclusions are based. |

**EXECUTIVE SUMMARY**

The third national waste baseline shows that South Africa generated approximately 108 million tonnes of waste in 2011, of which 97 million was disposed of at landfill. In the order of 59 million tonnes is general waste and 49 million tonnes is unclassified and hazardous waste. In the order of 10% of all waste generated in South Africa was recycled in 2011.

Determining a waste information baseline for South Africa is essential in order to track the implementation of the National Environmental Management: Waste Act (Act 59 of 2008) and the National Waste Management Strategy (DEA, 2012). This report therefore attempts to provide a national baseline for South Africa of the tonnages of waste recycled, treated, landfilled and exported. In the absence of a fully operating South African Waste Information System (SAWIS), a general lack of accurate waste data remains a huge challenge in South Africa. However, it is expected that the promulgation of the Waste Information Regulations (RSA, 2012) will provide the necessary incentives for accurate waste data to be reported onto SAWIS.

The data presented in this baseline report is not directly comparable to the 1991 (DEAT, 1991) and 1997 (DWAF, 2001) baselines due to the fact that the definition (and categorization) of waste has changed significantly. Previous baseline reports include by-products and mining waste while the by-products are now specifically excluded from the definition of waste. The Waste Act also states that “*this Act does not apply to residue deposits and residue stockpiles that are regulated under the Mineral and Petroleum Resources Development Act, 2002”.* The scope of this report was therefore limited to the Waste Act definition of waste.

No primary data was collected for the 2011 baseline study. Since the categorization of hazardous waste has recently changed from SANS 10228 to the new system (RSA, 2011; RSA, 2012) many organizations are still collecting data as per the old categories. Waste data sourced for this baseline was therefore not necessarily available according to the waste categories required for reporting. For instance, it was not possible to distinguish between the general and hazardous portions of waste streams in the absence of re-classification according to the new regulations. In such instances the waste streams are listed as ‘unclassified waste’ and reported together with hazardous waste.

**ABBREVIATIONS**

|  |  |
| --- | --- |
| AVCASA  BUSA  CAIA  CBA  DEA | Association of Veterinary and crop Associations of South Africa  Business Unity South Africa  Chemical and Allied Industries Association  Clay Brick Association  Department of Environmental Affairs |
| DEAT | Department of Environmental Affairs and Tourism (now DEA) |
| DEADP  EC  FAPA  FS | Department of Environmental Affairs and Development Planning, Western Cape  Eastern Cape  Ferro-Alloy Producers Association  Free State |
| GDACE | Gauteng Department of Agriculture, Conservation and Environment |
| GDP  GT  GW  HW | Gross Domestic Product  Gauteng  General Waste  Hazardous waste |
| IDP | Integrated Development Plan |
| IWMP  IWMSA  IZWA  KZN | Integrated Waste Management Plan  Institute of Waste Management of Southern Africa  Institute for Zero Waste in Africa  KwaZulu Natal |
| LDEDET  LP  MDALA  MP  NFMI  NW  NWDACE | Department of Economic Development, Environment and Tourism, Limpopo Province  Limpopo  Mpumalanga Department of Agriculture and Land Administration  Mpumalanga  Non-Ferrous Metal Industry Association of South Africa  North West  North West Department of Agriculture, Conservation and Environment |
| NWMSI  PAMSA  RCMSA  RPMASA  RSA  SAICI  SAISI  SAIMM  SALGA | National Waste Management Strategy Implementation  Paper Manufacturers Association of South Africa  Responsible Container Management Association of South Africa  Responsible Packaging Management Association of South Africa  Republic of South Africa  South African Institute of Civil Engineers  South African Iron and Steel Institute  South African Institute of Mining and Metallurgy  South African Local Government Association |
| SAWIS | South African Waste Information System |
| SAWIC  SAWPA  StatsSA  SPLM  TPSSA  WC  WEEE  WRC | South African Waste Information Centre ([www.sawic.org.za](http://www.sawic.org.za))  South African Wood Preservers Association  Statistics South Africa  Sol Plaatjie Local Municipality  Technical Association of Pulp and Paper Industry of South Africa  Western Cape  Waste electric and electronic equipment  Water Research Commission |

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# INTRODUCTION

## How to read the baseline

In order to facilitate easy access to the South African Waste Information Baseline, the report is structured to be short, focusing on the current waste information baseline as estimated for 2011. Background and supporting information is provided in the Appendices.

The waste information baseline reported here is a **best estimate** aimed at answering the question: *“How much waste is generated, stored, treated, re-used, recycled, recovered and disposed of in South Africa?”* The estimates reported here are based on modeled results which were informed by background research and interpretations of available data from various sources, as indicated in Appendix D. Although the available data does not support an answer at a very high level of accuracy, the overall accuracy of the data that was used in the predictions are deemed to be sufficiently high for the purposes of decision making at national level.

In this report, ***Section 1*** provides a short introduction to the background of the project and provides a summary of the methods used to get to the information baseline. Since no primary data was collected to establish this baseline, some comments are made on the accuracy of the available data on which these estimates are based. Stakeholders consulted during this project are listed in Appendix A.

The results of the modeled data are presented in ***Section 2***. The data is divided into relevant groups and the conclusions are presented. Only aggregated data is provided to protect the identity of the sources in line with the Competition Commission ruling (Appendix B). The results presented here are representative of the waste tonnage estimated for one year, namely 2011**.** Conclusions are drawn in ***Section 3.*** A summary of relevant literature pertaining to each waste type is provided in Appendix C.

The references listed refer to literature referenced in Sections 1 and 2. A complete list of all data sources consulted for this baseline is included in Appendix D.

## Background

Implementation of the National Environmental Management: Waste Act (Act 59 of 2008) (RSA, 2009) (hereinafter referred to as the Act) requires a baseline of waste information as evidence on which to base policy decisions and measure implementation. The Act states that the Minister must establish a national waste management strategy and may amongst others:

* Declare priority waste streams;
* Prescribe measures for the management of identified waste streams;
* Set targets for recycling of certain waste streams;
* Set targets for the minimization of certain waste streams; and
* Ban certain waste streams from landfill.

The National Waste Management Strategy (DEA, 2011) was approved by Cabinet in 2011 and sets targets to promote waste minimization, reuse, recycling and recovery of waste. The implementation of the strategy must be monitored and the strategy must be reviewed at least every five years. It is therefore imperative that the status quo of waste information in the country be recorded as accurately as possible and be made available to decision-makers in government and industry.

It is the intention of the Department of Environmental Affairs (DEA) to provide such a national baseline of the tonnages of waste recycled, treated, landfilled and exported, through the future implementation of the South African Waste Information System (SAWIS). However, until the SAWIS moves from voluntary reporting to enforced reporting under the new regulations (RSA, 2012), the system is as yet unable to provide annual reports on the state of waste. Given the constraints outlined above, this project aims to model the baseline of waste generation, recycling, treatment and landfilling in South Africa, while making use of existing waste data stored in provincial and national waste information systems, and in public and private reports. The results from the model represent the best estimate of waste generation, recycling, treatment and landfilling in South Africa in 2011 (as the baseline year).

The accuracy of general waste generation data in South Africa is often very low (Godfrey, 2008) and typically based on estimates. Domestic waste quantities are often estimated based on population statistics and economic activity within the municipality, while industrial waste quantities are largely estimated based on production figures. Waste data compared to production figures does however provide a good indication of process efficiencies within an industry. Where accurate information is available from industrial waste generators, the data is often considered to be sensitive or confidential. Similarly, in the case of commercial waste facilities, detailed waste treatment and disposal data, particularly on hazardous waste, is often considered as sensitive data since it can provide an indication of the company’s market share. For these reasons, accessing hazardous waste data (generation, treatment and disposal) was problematic, and was ultimately subject to a resolution by the Competition Commission. The DEA obtained a resolution on the confidentiality of information contained in the South African Waste Information System as well as on comments on the Waste Information Regulations (RSA, 2010). The Competition Commission resolution is attached as Appendix B.

Every effort has been made to collect waste data at the highest possible level of accuracy. However, it has not always been possible to do so for all waste streams, due to the issues discussed above, and due to the fact that some waste data is not yet collected and reported at the level of detail required for this study. It is anticipated that with the implementation of the waste information regulations and waste classification system, more accurate information will become available at the desired levels of detail in the foreseeable future.

## Objectives of the National Waste Information Baseline study

The objectives of this third national waste information baseline are to:

* Assist with the identification of problem waste streams or waste streams that occur in large quantities, and may require specific management strategies to manage their impacts;
* Support research towards determining the most appropriate storage, collection, treatment and disposal options for each waste stream;
* Support the diversion of waste from landfill thereby promoting waste reduction, re-use, recycling and waste exchange opportunities;
* Capacitate stakeholders and communities through public access to waste related information;
* Support government in meeting their national and international reporting obligations;
* In time, trace waste from point of generation through to point of treatment or disposal within South Africa.

# DEFINITIONS AND CLASSIFICATION OF WASTE

## Definitions

This third national waste information baseline is based on definitions as defined in the Act.

***“waste”*** *means any substance, whether or not that substance can be reduced, re-used, recycled and recovered –*

1. *That is surplus, unwanted, rejected, discarded, abandoned or disposed of;*
2. *Which the generator has no further use of for the purposes of production;*
3. *That must be treated or disposed of; or*
4. *That is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector; but –*
5. *A by-product is not considered waste; and*
6. *Any portion of waste, once re-used, recycled and recovered, ceases to be waste.*

*“****general waste****” means waste that does not pose an immediate hazard or threat to health or the environment, and includes:*

1. *Domestic waste;*
2. *Building and demolition waste;*
3. *Business waste; and*
4. *Inert waste.*

***“hazardous waste”*** *means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.*

***“building and demolition waste”*** *means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.*

## Waste classification

The DEA has recently gazetted draft Waste Classification Regulations for public comment (RSA, 2011). One of the aims of a national waste classification system is to standardize the reporting of waste data. Until recently, waste data has been captured differently, by different role players, which makes compiling data for a national waste baseline challenging. While hazardous waste has typically been reported on against SANS 10228 or a modified 10228, a standard classification for general waste has not, until recently, existed in South Africa. For example, ‘construction & demolition waste’ adopted in the draft waste classification system has also been referred to in other systems, and reported on, as ‘builders’ rubble’ and ‘builders’ waste’, while the Act defines ‘building and demolition’ waste (Section1) (RSA. 2008).

Draft waste information regulations were gazetted for public comment in 2010 (RSA, 2010) and finalized in 2012 (RSA, 2012). The purpose of the waste information regulations is to regulate the reporting on waste information for the protection of the environment and the management of waste. These regulations (RSA, 2012) include general and hazardous waste categories at levels 1, 2 and 3 of increasing detail. According to the Terms of Reference, the 2011 National Waste Information Baseline is to be reported on against these categories at level 2 (Table 1 and 2).

Previous baselines used different categories for reporting. Therefore, a direct comparison between the 1991, 1997 and 2011 baseline studies may not (in all cases) be possible (DEAT, 1991; DWAF, 2001). It should also be noted that the definition of waste as defined in the Act, excludes by-products, while earlier definitions of waste included by-products and as such would have been included in the 1991 and 1997 baselines.

Table 1: General waste categories

|  |  |  |
| --- | --- | --- |
| **Level 1** | **Level 2** | |
| General Waste | GW01 | Municipal waste |
| GW10 | Commercial and industrial waste |
| GW13 | Brine |
| GW14 | Fly ash and dust from miscellaneous filter sources |
| GW15 | Bottom ash |
| GW16 | Slag |
| GW17 | Mineral waste |
| GW18 | Waste of Electric and Electronic Equipment (WEEE) |
| GW20 | Organic waste |
| GW21 | Sewage sludge |
| GW30 | Construction and demolition waste |
| GW50 | Paper |
| GW51 | Plastic |
| GW52 | Glass |
| GW53 | Metals |
| GW54 | Tyres |
| GW99 | Other |

Table 2: Hazardous waste categories

|  |  |  |
| --- | --- | --- |
| **Level 1** | **Level 2** | |
| Hazardous Waste | HW01 | Gaseous waste |
| HW02 | Mercury containing waste |
| HW03 | Batteries |
| HW04 | POP Waste |
| HW05 | Inorganic waste |
| HW06 | Asbestos containing waste |
| HW07 | Waste Oils |
| HW08 | Organic halogenated and /or sulphur containing solvents |
| HW09 | Organic halogenated and/or sulphur containing waste |
| HW10 | Organic solvents without halogens and sulphur |
| HW11 | Other organic waste without halogen or sulphur |
| HW12 | Tarry and Bituminous waste |
| HW13 | Brine |
| HW14 | Fly ash and dust from miscellaneous filter sources |
| HW15 | Bottom ash |
| HW16 | Slag |
| HW17 | Mineral waste |
| HW18 | Waste of Electric and Electronic Equipment (WEEE) |
| HW19 | Health Care Risk Waste |
| HW20 | Sewage sludge |
| HW99 | Miscellaneous |

Further detail on the waste streams included in each waste category is provided in Appendix C.

# DETERMINING THE NATIONAL WASTE INFORMATION BASELINE

## Method

In the absence of a single waste dataset for South Africa, establishing a national waste baseline has been based on a strong scientific approach. In addition, ongoing consultation and engagement with identified stakeholders has been crucial to ensuring that all potential sources of waste data are identified and verified by peers in the waste sector.

A two-pronged approach was followed in developing the 2011 National Waste Information Baseline for South Africa:

1. Collection, collation and interpretation of existing waste data

2. Numerical modeling of the national waste baseline

The existing data was collected from all relevant stakeholders in the South African waste sector, including both public and private waste organisations, by means of interviews and extracting data from available reports and databases. A list of identified stakeholders is included as Appendix A.

In addition to basic data collection, numerical modelling was undertaken in the following instances:

* data simulation in the absence of accurate data;
* assessing the effectiveness of current reduce, reuse and recycling initiatives;
* determining the extent of energy recovery from waste;
* estimating trends in waste management over time;
* verifying the accuracy of available data.

Modeling of waste generation via a well calibrated model that contains all readily available waste data, as well as forecasted type and number of waste generators is considered to be a reliable and cost-effective method to achieve the project objectives.

## Data verification

Since no primary data collection was undertaken in the preparation of this report, it was important to verify the accuracy of the data as collected from available sources.

### SAWIS

The Department of Environmental Affairs (DEA) developed and piloted the South African Waste Information System (SAWIS) between 2004 and 2006 as part of the National Waste Management Strategy Implementation (NWMSI) project. The aim of SAWIS is to create a single national repository of accurate and reliable tonnages of general and hazardous waste recycled, treated and landfilled, as well as tonnages of waste exported out of South Africa (DEAT, 2005). SAWIS has continued to be implemented by DEA on a voluntary basis since the end of the project in 2006, pending the drafting and gazetting of national waste information regulations (RSA, 2012).

However, research suggests that the number of waste activities reporting to SAWIS as at 2011 represents only a small fraction of operating waste facilities in the country. For example, the number of landfills reporting data to SAWIS in 2011 represents an estimated 12-13% of currently operating landfills that would be required to submit data as per the SAWIS framework (Godfrey et al, 2012; DEAT, 2005). Organisations reporting data to SAWIS include municipalities, industries and private waste companies (DEA, 2005). Only 38 organisations reported data to the SAWIS in 2010 while 32 organisations reported data into the system for both 2009 and 2010 (Godfrey et al. in press). There are over 2000 waste handling facilities in South Africa (DEAT, 2007) but only 46 waste activities reported data to the SAWIS in 2010 (29 landfills; 9 treatment facilities and 8 re-processors) (Godfrey et al. 2012). The small fraction of operating waste facilities reporting into the system renders the SAWIS data incomplete for the purposes of establishing a national waste baseline. In addition, given the voluntary status of SAWIS, data within the system has not yet been validated for accuracy. Reviewing the SAWIS data suggests that there are inaccuracies within the system which will need to be corrected, such as order of magnitude changes in waste tonnages from one month to the next, suggesting a data capturing error in the placing of the decimal figure, or order of magnitude differences in data for landfills of similar size, suggesting lack of consistency in units, i.e. tonnages versus kilograms. It is acknowledged that reporting into the SAWIS is still voluntary and that increased reporting is to be expected following the promulgation of Waste Information Regulations.

So, while the data in SAWIS is useful to benchmark calculations made during this baseline project, SAWIS cannot as yet provide a complete overview of waste data for South Africa. In addition to SAWIS, the Western Cape and Gauteng provincial departments of environment embarked on developing their own waste information systems. Although the two provincial waste information systems are not fully operational at the time of this study, as with SAWIS, data from provincial systems has been used to verify calculations made in this project.

### General Waste

Most municipal integrated waste management plans (IWMP) highlighted concerns around the accuracy of waste data (DEADP, 2011) e.g. “not accurate”, “theoretical” or “assumed to be typical”. Few waste characterization studies have been undertaken in South Africa (Silbernagl, 2012), which further complicates the issue of reporting waste streams at the required level of detail. Where waste characterization studies have been undertaken, these studies have used different methods and waste categories, which make direct comparison difficult (Wise *et al*., 2011). Other limiting factors of available characterization studies include the low number of samples, limited sampling periods (often only done in one season) and sorting accuracy (SPLM, 2010).

A study on the collection of waste information by municipalities (Godfrey, 2008) revealed that in 2005 only 68.9% of municipalities were collecting some form of waste data. Sixty two percent of those municipalities collecting data believed that they were collecting unreliable data. It was further reported that 74.6% of municipalities collecting waste data were collecting data on landfills and 46.5% data on waste generators (not waste generation). Only 33.8% collected data on waste transportation, 14.1% on recyclers and 4.2% on waste treatment (Godfrey, 2008). Since the municipalities collecting waste data often do so at landfills, only waste disposed of at municipal landfills are accounted for. In addition, when comparing service delivery data from the Community Survey, 2007 (StatsSA, 2007) with the annual service delivery survey for the same year, the service backlog figures differs significantly (National Treasury, 2011). It could therefore be expected that estimates of waste that are not accounted for, is also a challenge. While fairly extensive waste data is now collected by metropolitan municipalities, it is clear that accurate municipal waste data, for the majority of municipalities in South Africa, is not available.

### Hazardous waste

Provincial hazardous waste plans (HWMP) also indicated some reservations about the accuracy of the waste data reported. Data surveys undertaken by service providers during the development of provincial HWMPs are characterised by poor response rates. It is reported that “*the majority of those interviewed do not fully comprehend what constitutes hazardous waste and do not (as a rule) record volumes generated*” (LDEDET, 2006). The small sample (5.3%) of industrial operations included in the survey for the Gauteng HWMP does not provide enough data for accurate waste generation estimations (GDACE, 2007). The data collected through surveys are generally statistically insignificant and therefore not suitable for use in waste generation extrapolations.

In instances where hazardous waste quantities are not measured, estimates are generally made by extrapolation or by using industry averages for hazardous waste generation rates for similar manufacturing facilities (MDALA, 2008; NWDACE, 2006; LDEDET, 2006). However this approach is complicated by the fact that most local authorities do not have readily available information on the industries operating in their areas (LDEDET, 2005). It is therefore difficult to ascertain the exact size of each industrial sector and hence virtually impossible to determine the exact volume of hazardous waste generated by a specific sector in a specific province.

Hazardous waste generators located at distances greater than 100 km from hazardous waste treatment facilities or landfills are faced with huge financial implications for waste haulage. A general reluctance to release information relating to waste by these companies is therefore reported (DEADP, 2011). Many large industries in South Africa dispose of industrial waste on-site. Waste generation at these facilities is seldom measured but it is often calculated based on production figures or resource input versus operational efficiency. Since this hazardous waste does not enter the ‘formal’ waste stream, there is also often little reported data available.

The status of hazardous waste in South Africa is therefore largely based on treatment and disposal figures. The most reliable data are obtained from commercial waste treatment and disposal facilities where the generators are charged for the treatment or disposal of the hazardous waste based on weight or volume.

There are instances where in-depth research projects were undertaken on certain waste types i.e. brines. The data contained in research reports on these waste streams are considered to be accurate.

## Baseline year

Since different waste streams are not always available for consecutive years, deciding on the baseline year, based on available information, was challenging. For this reason, all data was captured and normalized to one baseline year (2011), from which future projections were made.

## Calculations

The waste quantities have been calculated from various sources and typically from different years to the agreed baseline year of 2011. Furthermore, waste quantities often only cover one municipality or one province. Calculations from province level to national level, or from one year to the baseline year, have been based on either population or economic data, e.g.

|  |  |
| --- | --- |
|  | (1) |

The latest available official population statistics (Table 3) and economic data (Table 4) published by Statistics South Africa, were used in the calculations of general and hazardous waste generation figures for South Africa.

Table 3: Population distribution per province (StatsSA, 2010; \*StatsSA, 2011a).

| **Province** | **Total population (thousand)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011\*** |
| Western Cape (WC) | 4646 | 4755 | 4859 | 4964 | 5071 | 5162 | 5258 | 5369 | 5468 | 5288 |
| Eastern Cape (EC) | 6521 | 6541 | 6558 | 6574 | 6587 | 6612 | 6633 | 6649 | 6656 | 6830 |
| Northern Cape (NC) | 1088 | 1098 | 1106 | 1115 | 1123 | 1131 | 1140 | 1148 | 1154 | 1097 |
| Free State (FS) | 2777 | 2795 | 2811 | 2826 | 2842 | 2863 | 2884 | 2905 | 2919 | 2760 |
| KwaZulu Natal (KZN) | 9683 | 9802 | 9915 | 10024 | 10134 | 10242 | 10348 | 10461 | 10551 | 10819 |
| North West (NW) | 3227 | 3261 | 3294 | 3325 | 3357 | 3389 | 3421 | 3454 | 3479 | 3253 |
| Gauteng (GT) | 9189 | 9387 | 9577 | 9766 | 9961 | 10142 | 10333 | 10556 | 10754 | 11328 |
| Mpumalanga (MP) | 3391 | 3430 | 3464 | 3493 | 3519 | 3546 | 3576 | 3610 | 3639 | 3657 |
| Limpopo (LP) | 5011 | 5048 | 5081 | 5111 | 5138 | 5171 | 5201 | 5230 | 5250 | 5555 |
| Total | 45533 | 46117 | 46665 | 47198 | 47732 | 48258 | 48794 | 49382 | 49870 | 50587 |

Table 4: GDP contribution per province (StatsSA, 2011b).

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Economic data 2000-2009 - Current prices - Rand million** | | | | | | |  |  | **Calculated data** | |
|  | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** |
| WC | 165 265 | 183 462 | 209 602 | 229 150 | 256 935 | 293 243 | 324 381 | 336 234 | 342 958 | 349 818 |
| EC | 91 123 | 101 806 | 112 592 | 123 551 | 135 503 | 151 785 | 172 375 | 182 146 | 185 789 | 189 505 |
| NC | 25 793 | 28 167 | 30 776 | 34 049 | 39 454 | 45 497 | 52 526 | 54 916 | 56 014 | 57 135 |
| FS | 65 847 | 69 424 | 76 219 | 81 361 | 95 333 | 108 552 | 122 369 | 130 973 | 133 592 | 136 264 |
| KZN | 191 433 | 209 133 | 232 571 | 254 938 | 285 663 | 324 961 | 363 511 | 384 936 | 392 635 | 400 488 |
| NW | 77 109 | 80 082 | 87 932 | 100 628 | 114 068 | 130 071 | 149 947 | 156 373 | 159 501 | 162 691 |
| GT | 392 705 | 428 624 | 477 927 | 539 120 | 598 114 | 685 942 | 765 323 | 811 906 | 828 144 | 844 707 |
| MP | 83 162 | 87 432 | 94 980 | 104 168 | 122 069 | 138 841 | 161 609 | 169 973 | 173 372 | 176 840 |
| LP | 78 644 | 84 403 | 92 669 | 104 112 | 120 279 | 137 269 | 162 093 | 168 505 | 171 876 | 175 313 |
| Total | 1 171 081 | 1 272 533 | 1 415 268 | 1 571 077 | 1 767 418 | 2 016 161 | 2 274 134 | 2 395 962 | 2 443 881 | 2 492 761 |

### Waste generation per province

In the absence of more recent data, and comprehensive waste characterization studies, it is assumed that the per capita waste generation per province as quoted by Fiehn and Ball (2005) is still relevant in 2011. The percentage municipal waste contribution by province was therefore calculated based on population and is estimated as indicated in Table 5.

Table 5: Percentage municipal waste contribution by province in South Africa, 2011

|  |  |  |
| --- | --- | --- |
| **Province** | **kg/capita/annum** | **Waste generated as % of Total waste** |
| Western Cape | 675 | 20 |
| Eastern Cape | 113 | 4 |
| Northern Cape | 547 | 3 |
| Free State | 199 | 3 |
| KwaZulu Natal | 158 | 9 |
| North West | 68 | 1 |
| Gauteng | 761 | 45 |
| Mpumalanga | 518 | 10 |
| Limpopo | 103 | 3 |

However, the calculations used to normalise data to the baseline year, assumed equal per capita waste generation across provinces.

### Municipal waste composition

Only a few waste characterization studies on municipal waste have been undertaken to date, in South Africa. Organic waste is sometimes split into putrescibles, greens and garden waste. However, if these waste streams are added together and reported as organic waste, it is possible to find comparable data for Gauteng (GDACE, 2008) and Cape Town (Gibb, 2008), as illustrated in Figures 1.

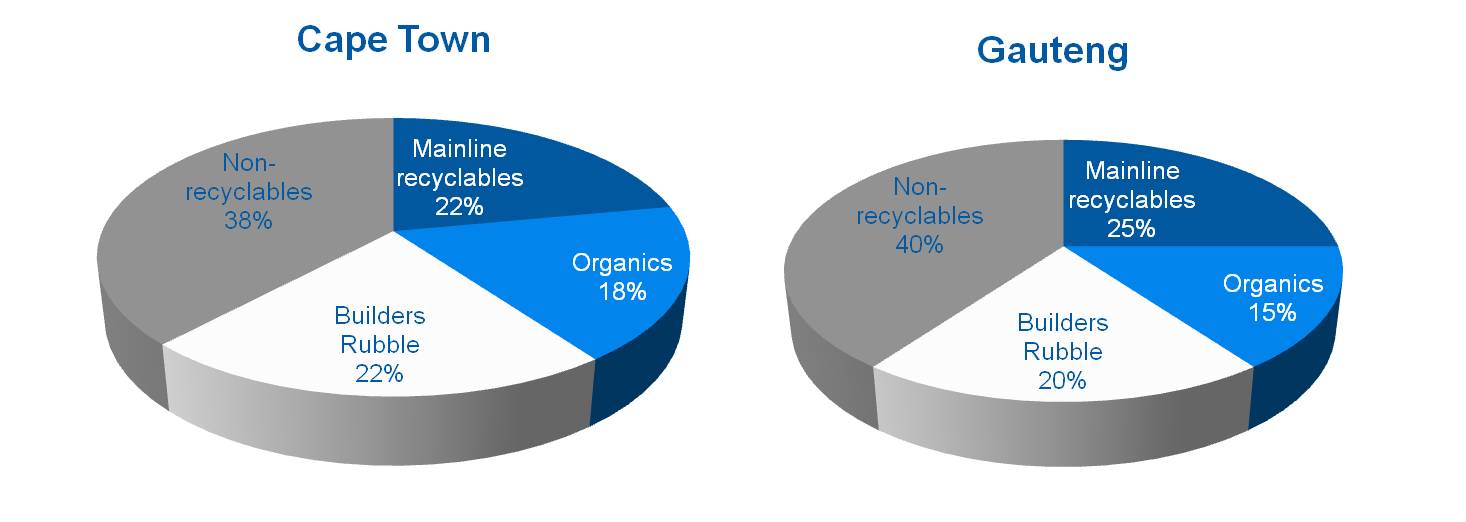


Figure 1: Municipal waste composition (Percentage by Mass)

There are no statistically significant differences in the findings between Gauteng and Cape Town. Therefore, it was assumed that the municipal waste composition for Gauteng could be extrapolated to fairly represent the composition of municipal waste in South Africa.

The municipal waste composition for Gauteng was therefore applied to calculate GW20 (organic waste, 15%) and GW30 (construction and demolition waste, 20%) (Table 5).

The waste reported as mainline recyclables include paper, plastics, glass, tins and tyres (GDACE, 2008; Gibb, 2008). These waste streams are already reported under GW20, GW30, GW50, GW51, GW52, GW53 and GW54 since these waste streams includes the recyclables from municipal waste as well as recyclables collected directly from industrial sources. In order to avoid double-counting only the non-recyclable portion (40%) is reported under GW01 (Table 6).

### Commercial and industrial waste

Commercial and industrial waste is reported as part of the municipal waste stream in Cape Town (2004), Johannesburg, (2004), Tshwane (2004) and Mangaung (no date) as illustrated in Figure 2.

It was assumed that the waste streams “illegal dumping” and “other”, recorded in Johannesburg, would be coming from household sources and was therefore added to household waste in Johannesburg. In addition all waste, excluding household waste, organics and construction and demolition waste would be coming from commercial and industrial sources.

Data reported by municipalities includes both household, commercial and industrial waste (referred to as municipal waste). For the purposes of this study and to be able to separate out the commercial and industrial waste, this waste type (GW 10) was assumed to contribute about 21% of the municipal waste stream in South Africa. Household waste is about 44% (average for Tshwane, Mangaung, Johannesburg and Cape Town as illustrated in figure 2), organics 15% and contruction and demolition waste 20% as determined in section 3.4.2. (Table 6).

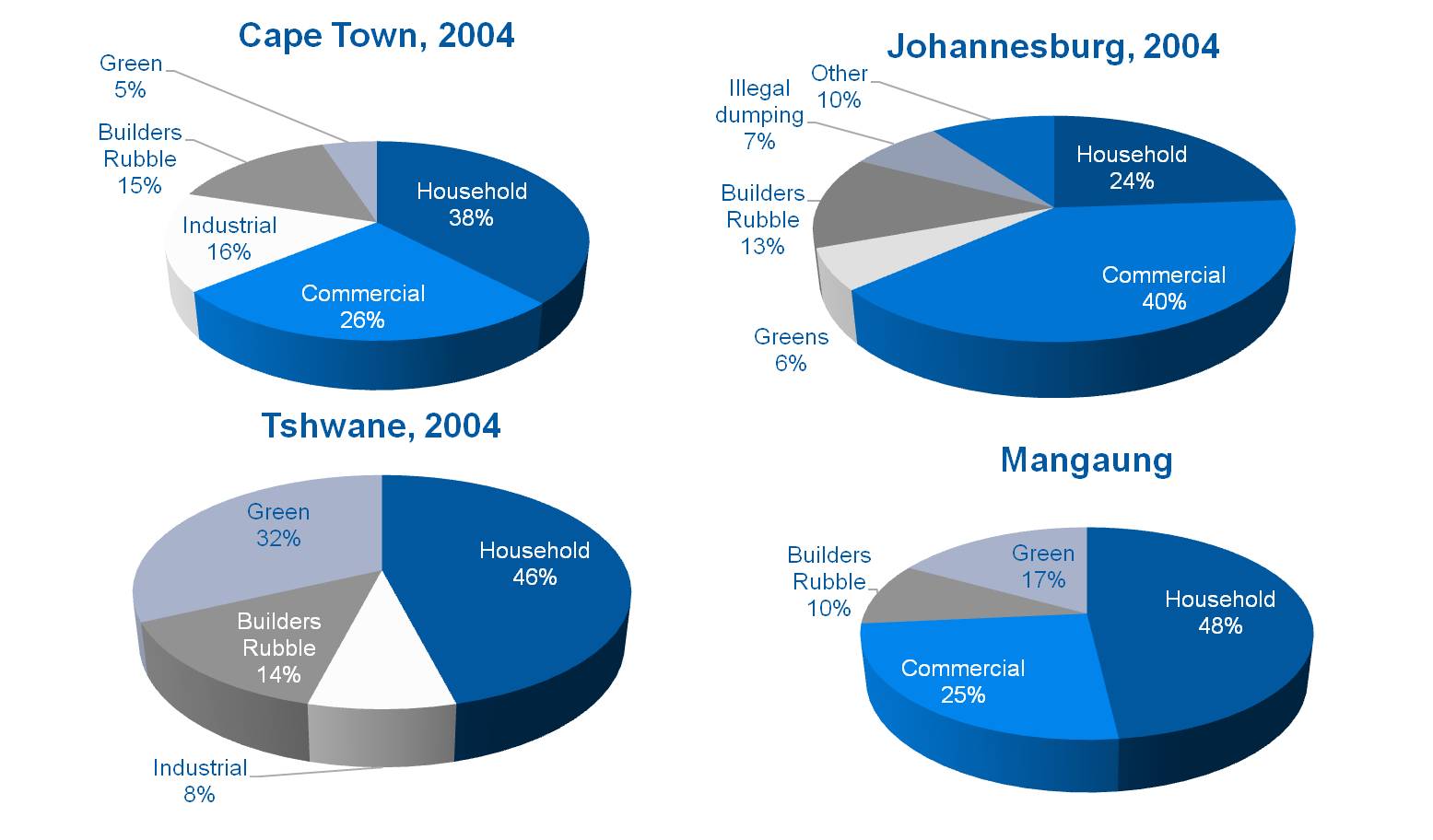


Figure 2: Municipal waste composition by source

### Avoiding double counting

Double counting is a real concern especially in determining the amounts of general waste reported in the baseline. Many of the waste categories listed as general waste are also reported under municipal waste (GW01) and commercial and industrial waste (GW10). This is especially true for the recyclable waste types. Commercial and industrial waste (GW10), as determined in Section 3.4.3, represents 21% of the municipal waste stream (GW01) and the recyclable content is reported under GW20, GW30, GW50, GW51, GW52, GW53 and GW54. Adding GW10 to the equation when counting total general waste will result in double counting. For this reason GW10 is left out of the equation.

It was also necessary to determine which portion of the municipal waste is non-recyclable. Based on the assumptions made in sections 3.4.1 to 3.4.3, it is possible to conclude that 60% of the municipal waste stream is reported as GW30 (20%), GW20 (15%) and mainline recyclables (i.e. paper, plastics, glass, metals and tyres) (25%). The remaining 40% of municipal waste is therefore assumed to be non-recyclable and not recorded elsewhere.

It can therefore be concluded that the total general waste generated in South Africa is the sum of 40% of GW01 and all the GW- waste streams excluding GW10.

### Waste quantity calculation by category

In most cases the waste quantities are given for ‘waste generated’. However, in some cases it has only been possible to find data on waste collection, treatment or disposal. This division in methodology has been impossible to avoid because of the lack of comprehensive data and differences in data collection approaches. However, the differences are highlighted in Table 6 and Table 7 and the reader will thus know which methodology has been used to derive the given amounts.

Table 6: Calculation methods applied to general waste categories

| **General Waste 2011** | | **Calculation Comment** |
| --- | --- | --- |
| GW01 | Municipal waste | (Western Cape amount 2010/ Western Cape population 2010\* SA population 2011 (refer to Table 3) = **19 419 600**. To avoid double counting only 40% of total adjusted to 2011 is reported here (refer to section 3.4.2). The remaining 60% is reported against specific waste streams i.e. GW20, GW30, GW50 etc. |
| GW10 | Commercial and industrial waste | 21% of total GW01 based on Municipal waste compositions (2004) for Cape Town, Johannesburg, Tshwane and Mangaung (refer to section 3.4.3) |
| GW13 | Brine | See Table 6 |
| GW14 | Fly ash and dust from miscellaneous filter sources | See Table 6 |
| GW15 | Bottom ash | See Table 6 |
| GW16 | Slag | See Table 6 |
| GW17 | Mineral waste | See Table 6 |
| GW18 | Waste of Electric and Electronic Equipment (WEEE) | See Table 6 |
| GW20 | Organic waste | Organic component of Municipal solid waste (15%) based on the estimate for Gauteng in 2008 waste minimisation status quo report |
| GW21 | Sewage sludge | See Table 6 |
| GW30 | Construction and demolition waste | Recycling data South Africa amount 2007/South Africa GDP 2007 \* South Africa GDP 2011 (refer to Table 4) plus disposal data estimated at 20% of municipal waste (GDACE, 2008) |
| GW50 | Paper | South Africa amount 2009/South Africa population 2009\*South Africa population 2011 (refer to table 3) |
| GW51 | Plastic | South Africa amount 2009/South Africa population 2009\*South Africa population 2011 (refer to table 3) |

|  |  |  |
| --- | --- | --- |
| **General Waste 2011** | | **Calculation Comment** |
| GW52 | Glass | South Africa amount 2010/South Africa population 2010\*South Africa population 2011 (refer to table 3) |
| GW53 | Metals | South Africa amount 2010/South Africa GDP 2010\*South Africa GDP 2011 (refer to table 4) |
| GW54 | Tyres | South Africa amount 2008/South Africa GDP 2008\* South Africa GDP 2011 (refer to table 4) |
| GW99 | Other | Biomass waste from industry. South Africa amount 2004/South Africa GDP 2004\*South Africa GDP 2011 (refer to table 4). |
|  | Total General Waste | GW01+GW13+GW20+GW30+GW50+GW51+GW52+GW53+GW54+GW99 |

Table 7: Calculation methods applied to hazardous waste categories (including unclassified waste)

|  |  |  |
| --- | --- | --- |
| **Hazardous and unclassified waste** | | **Calculation comments** |
| HW01 | Gaseous waste | South Africa amount 2010\*2% increase |
| HW02 | Mercury containing waste | South Africa amount 2010\*2% increase |
| HW03 | Batteries | Mpumalanga amount 2008/Mpumalanga population 2008\*South Africa population 2011 (refer to Table 3) |
| HW04 | POP Waste | South Africa amount 2010\*2% increase |
| HW05 | Inorganic waste | South Africa amount 2010/south Africa population 2010\*South Africa population 2011 (refer to Table 3) |
| HW06 | Asbestos containing waste | South Africa amount 2010/South Africa population 2010\*South Africa population 2011 (refer to Table 3) |
| HW07 | Waste Oils | South Africa amount 2011 |
| HW08 | Organic halogenated and /or sulphur containing solvents | Western Cape amount 2002/Western Cape population 2002\*South Africa population 2011 (refer to Table 3) |
| HW09 | Organic halogenated and/or sulphur containing waste | North West amount 2006/North West population 2006\*South Africa population 2011 (refer to Table 3) |
| HW10 | Organic solvents without halogens and sulphur | North West amount 2006/North West population 2006\*South Africa population 2011 (Refer to Table 3) |
| HW11 | Other organic waste without halogen or sulphur | South Africa amount 2010/South Africa population 2010\*South Africa population 2011 (Refer to Table 3) |
| HW12 | Tarry and Bituminous waste | South Africa amount 2010\*2% increase |
| HW13 & GW13 | Brine | Tonnes of salt to the environment. South African amount 2008/South Africa GDP 2008\*South Africa GDP 2011 (refer to Table 4). |
| HW14 & GW14 | Fly ash and dust from miscellaneous filter sources | South Africa 2010\*2% increase |
| HW15 & GW15 | Bottom ash | South Africa 2010\*2% increase |
| HW16 & GW16 | Slag | South Africa 2011 Estimated based on production figures (refer to Appendix C) |
| HW17 & GW 17 | Mineral waste | South Africa amount 2011 |
| HW18 & GW18 | Waste of Electric and Electronic Equipment (WEEE) | South Africa amount 2007/South Africa population 2007\*South Africa population 2011 (refer to Table 3) |
| HW19 | Health Care Risk Waste | South Africa amount 2007/South Africa population 2007\* South Africa population 2011 (refer to Table 3) |
| HW20 & GW 21 | Sewage sludge | South Africa amount 2010/South Africa population 2010\*South Africa population 2011 (refer to Table 3) |
| HW99 | Miscellaneous | South Africa amount 2010\*2% increase |
|  | Total Hazardous and Classificed waste | The sum of all HW waste categories |

# RESULTS: WASTE GENERATION IN SOUTH AFRICA, 2011

The data presented in the tables below (Table 8 and 9) is the initial calculation of national data for the whole of South Africa. Data has been collected from various sources and verified by the project team, stakeholders and also by outside experts. The same figures according to waste management option are presented in Tables 8 and 9.

A number of waste types are duplicated in Schedule 1 for reporting to the South African Waste Information System, thus appearing under general and hazardous waste. In the absence of analytical data to inform the distinction between hazardous and non-hazardous portions of these waste types, these wastes are reported in Table 9 as unclassified waste.

## General waste

According to the modeled waste data, South Africa generated 59 million tonnes of general waste in 2011 (Table 8). An estimated 5.8 million tonnes of general waste was recycled (~10%) with the remaining 53 million tonnes of general waste being landfilled (Table 8). Municipal (GW01) and commercial and industrial waste (GW10), generated within municipalities represents a total of **19 419 600 tonnes** when the recyclables (reported under GW 30, GW 50, GW51, GW52, GW53 and GW54) are included. The percentage contribution of each waste stream to the composition of general waste is illustrated in Figure 3. Non-recyclable municipal waste contributes 34% (by weight) of the overall general waste, construction and demolition waste, 21%, followed by metals (14%), organic waste 13% and mainline recyclables (including paper, plastics, glass and tyres (18%).



Figure 3: The waste composition for general waste, 2011 (percentage by mass), (excluding GW99- Other, which is mainly biomass waste from industrial sources).

Table 8: General waste by management option - 2011

| **General Waste 2011** | | **Generated** | **Recycled** | **Disposed** | **Recycled** |
| --- | --- | --- | --- | --- | --- |
| **Tonnes** | | | **%** |
| GW01 | Municipal waste | 7 878 564 | - | 7 878 564 | 0 |
| GW10 | Commercial and industrial waste | 12 111 267 | 9 325 676 | 2 785 591 | 77 |
| GW13 | Brine | See Table 9 | | | |
| GW14 | Fly ash and dust from miscellaneous filter sources | See Table 9 | | | |
| GW15 | Bottom ash | See Table 9 | | | |
| GW16 | Slag | See Table 9 | | | |
| GW17 | Mineral waste | See Table 9 | | | |
| GW18 | Waste of Electric and Electronic Equipment (WEEE) | See Table 9 | | | |
| GW20 | Organic waste | 2 954 461 | 1 034 061 | 1 920 400 | 35 |
| GW21 | Sewage sludge | See Table 9 | | | |
| GW30 | Construction and demolition waste | 4 725 542 | 756 087 | 3 969 455 | 16 |
| GW50 | Paper | 1 694 752 | 966 009 | 728 743 | 57 |
| GW51 | Plastic | 1 278 713 | 230 168 | 1 048 545 | 18 |
| GW52 | Glass | 937 869 | 300 118 | 637 751 | 32 |
| GW53 | Metals | 3 121 203 | 2 496 962 | 624 241 | 80 |
| GW54 | Tyres | 246 631 | 9 865 | 236 766 | 4 |
| GW99 | Other | 36 171 127 | - | 36 171 127 | 0 |
| **Total general waste [T]** | | **59 008 862** | **5 793 271** | **53 215 591** | **10** |

(-) means no data on recycling was available. GW01 – only the non-recyclable portion is reported here.

### Trends

While it has been mentioned that the 2011 Baseline data is not directly comparable to previous studies, it is useful to place the data in the context of other studies as a means of benchmarking the results and to reflect on trends and growth rates in general waste generation in South Africa over the past decade.

Based on the data presented in Figure 4, growth rates for general waste were calculated –

* Using the DWAF (2001) 1997 and 2010 modeled data results in a growth rate in general waste of 3.26% per annum
* Using the DEAT (2001) 2006 and the DEA (2009b) data results in a growth rate in general waste of 3.95% per annum
* Using the DEA (2012) 2002 to 2010 modeled data results in a growth rate in general waste of 1.57% per annum



Figure 4: Analysis of available general waste data (from municipalities) for South Africa

Notes on Figure 4:

*DWAF (2001a) – Baseline 1997 general waste disposal (questionnaires at landfill)*

*DWAF (2001b) – Baseline 1997 domestic & commercial (general waste) generation (calculated from population)*

*DEAT (2006a) – Environmental Outlook 2006 domestic waste generated (calculated from population)*

*DEAT (2006b) – Strategic Framework for Sustainable Development in SA, municipal solid waste (no info on method)*

*DEA (2009a) – NWMS Research Paper, total general waste disposed (2006/7) (Purnell adapted from DEA, 2007)*

*DEA (2009b) – NWMS Research Paper, total general waste collected (2006/7) (Purnell adapted from DEA, 2007)*

*DEA (2012a) – National waste information baseline, municipal waste generation (calculated from population)*

*DEA (2012b) – National waste information baseline, municipal waste generation (refer to Table 6)*

According to DEA (2006b) “*MSW quantities are growing faster than the economy in many cities – for example, at 5% per annum in Cape Town*”. Fiehn & Ball (2005) suggested a current growth rate envelope of between 2-3% per annum from a starting tonnage of ±15mT/a. Calculating general waste tonnages based only on annual increases in population may be under-estimating the quantities of general waste produced, as suggested by the low generation rate of 1.57% (DEA, 2012a) (Figure 4). It is therefore suggested that the modeled municipal waste generation rate referred to in Table 6 is likely to be a fair estimate of the municipal waste generation in South Africa in 2011.

## Unclassified and Hazardous waste

According to the modeled waste data, South Africa generated 49 million tonnes of unclassified and hazardous waste in 2011 (Table 9). An estimated 4.8 million tonnes of hazardous and unclassified waste was recycled, and 85 million tonnes treated, with the remaining 44 million tonnes being landfilled (Table 9). It is clear from Figure 6 that the bulk of the waste is currently unclassified, with fly ash and dust from miscellaneous sources contributing 64%, bottom ash, 11.7% and slag 10.9%.

Table 9: Hazardous and unclassified waste by management option - 2011

| **Hazardous and Unclassified Waste** | | **Generated** | **Recycled** | **Treated** | **Landfilled** | **Recycled** |
| --- | --- | --- | --- | --- | --- | --- |
| **Tonnes** | | | | **%** |
| HW01 | Gaseous waste | 55 | - | 55 | - | - |
| HW02 | Mercury containing waste | 868 | - | - | 868 | - |
| HW03 | Batteries | 32 912 | 32 254 | - | 658 | 98 |
| HW04 | POP Waste | 486 | - | 80 | 406 | - |
| HW05 | Inorganic waste | 283 520 | - | - | 283 520 | - |
| HW06 | Asbestos containing waste | 32 508 | - | - | 32 508 | - |
| HW07 | Waste Oils | 120 000 | 52 800 | - | 67 200 | 44 |
| HW08 | Organic halogenated and /or sulphur containing solvents | 109 | - | - | 109 | - |
| HW09 | Organic halogenated and/or sulphur containing waste | 8 198 | - | 64 | 8 134 | - |
| HW10 | Organic solvents without halogens and sulphur | 753 | - | - | 753 | - |
| HW11 | Other organic waste without halogen or sulphur | 198 073 | - | - | 198 073 | - |
| HW12 | Tarry and Bituminous waste | 255 832 | - | - | 255 832 | - |
| HW13 & GW13 | Brine | 4 166 129 | - | - | 4 166 129 | - |
| HW14 & GW14 | Fly ash and dust from miscellaneous filter sources | 31 420 488 | 1 885 229 | - | 29 535 259 | 6 |
| HW15 & GW15 | Bottom ash | 5 717 324 | - | - | 5 717 324 | - |
| HW16 & GW16 | Slag | 5 370 968 | 2 685 484 | - | 2 685 484 | 50 |
| HW17 & GW 17 | Mineral waste | 369 000 | - | - | 369 000 | - |
| HW18 & GW18 | Waste of Electric and Electronic Equipment (WEEE) | 62 581 | 6 884 | - | 55 697 | 11 |
| HW19 | Health Care Risk Waste | 45 232 | - | 45 232 | - | - |
| HW20 & GW 21 | Sewage sludge | 657 963 | 125 013 | 39 478 | 493 472 | 19 |
| HW99 | Miscellaneous | 327 250 | - | - | 327 250 | - |
| **Total Hazardous & Unclassified [T]** | | **49 070 249** | **4 787 664** | **85 555** | **44 197 030** | **10** |

(-) Blank cell means that we have no data on this waste stream being recycled or treated.

Both fly ash and slag has significant recycling potential in the cement and construction industry as aggregates and cement extenders. It is therefore possible to significantly reduce the amount of unclassified waste disposed at landfill by optimizing and extending the recycling potential of these waste streams. Fly ash is a case in point where “*ash utilization is a sustainable business providing cost –effective solutions to pertinent problems*” (Kruger and Krueger, 2005).

Figure 6: Percentage (by mass) composition of Unclassified and Hazardous waste, 2011.

# CONCLUSIONS

From the modeling of available data, it can be concluded that South Africa generated approximately 108 million tonnes of waste in 2011, of which 97 million was disposed of at landfill. In the order of 59 million tonnes is general waste and 49 million tonnes is unclassified and hazardous waste. In the order of 10% of all waste generated in South Africa was recycled in 2011. Waste management in South Africa is thus still heavily reliant on landfilling as a waste management option.

Determining a national waste information baseline for South Africa for 2011 has proven extremely challenging due to a general lack of accurate waste data reporting. The fact that all waste streams are not currently classified and/or reported according to the new waste types as specified in Schedule 1 (RSA, 2012), added to the challenge. Waste streams listed both under general and hazardous waste of Schedule 1 (RSA, 2012) has been reported as ‘unclassified waste’ combined with hazardous waste since it is not possible to split the hazardous and non-hazardous components in the absence of analytical data. Despite being unable to accurately split the waste between General and Hazardous waste, the reported amounts are deemed as fair estimates to inform policy decisions.

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