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Waste Management, Strategies and Situation in South Africa: An Overview

Edison Muzenda, Freeman Ntuli and Tsietsi Jefrey Pilusa

Abstract**—**This paper highlights some interesting facts on South African's waste situation and management strategies, in particular the Integrated Waste Management. South Africa supports a waste hierarchy by promoting cleaner production, waste minimisation, reuse, recycling and waste treatment with disposal and remediation as the last preferred options in waste management. The drivers for waste management techniques are identified as increased demand for waste service provision; increased demand for waste minimisation; recycling and recovery; land use, physical and environmental limitations; and socio-economic and demographic factors. The South African government recognizes the importance of scientific research as outlined on the white paper on Integrated Pollution and Waste Management (IP and WM) (DEAT, 2000).

Keywords**—**Cleaner production, demographic factors, environmental quality, integrated waste management, hierarchy, recycling

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I. Introduction

MUNICIPAL solid waste management (MSWM) pose serious challenges in many countries. Most countries do not collect all the waste generated, and only a fraction of the collected waste receives proper disposal. The insufficient collection, utilization and inappropriate disposal of solid waste causes water, land and air pollution thus negatively impacting on human health and the environment.

Globalization, rapid urbanization as well as population and economic growth in the developing world tend to increase the challenges. It is estimated that in 2006 the total amount of municipal solid waste (MSW) generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003, Global Waste Management Market Report 2007 [1]. It is further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3%, equivalent to roughly 8% increase per year. South Africa generates millions of tons of waste per year from industry, businesses and households. The 1999 State of Environment Report for South Africa, DEAT, 1999 [2] reported that over 42 million cubic metres of general waste is generated every year with the largest contributor being Gauteng Province (42%), Fig 1 (DWARF 1997) [3]. In addition, more than 5 million cubic metres of hazardous waste is produced every year, mostly in Mpumalanga and Kwazulu Natal due to the concentration of mining activities and fertilizer production in these provinces.

E. Muzenda is with the Department of Chemical Engineering, Faculty of Engineering and the Built Environment, University of Johannesburg, Doornfontein, Johannesburg 2028, Tel: +27115596817, Fax: +27115596430, Email: emuzenda@uj.ac.za.

F. Ntuli is with the Department of Chemical Engineering, Faculty of Engineering and the Built Environment, University of Johannesburg, Doornfontein, Johannesburg 2028, Tel: +27115596003, Fax: +27115596430, Email: fntuli@uj.ac.za.

T. J. Pilusa is with the Process, Energy and Environmental Technology Station, Faculty of Engineering and the Built Environment, University of Johannesburg, Doornfontein, Johannesburg 2028, Tel: +27115596438, Fax: +27115596430, Email: jefreyp@uj.ac.za.

The average amount of waste generated per person per day was 0.7 kg. This is closer to the amount produced in developed countries (0.73kg in the UK and 0.87 kg in Singapore than to the average in developing countries such as 0.3kg in Nepal (DWARF 1997) [3]. The biggest waste contributor to the solid waste stream is mining waste (72.3%), followed by pulverized fuel ash (6.7%), agricultural wastes (6.1%), urban waste (4.5%) and sewage sludge (3.6%), van der Merwe and Vosloo, 1992 [4].

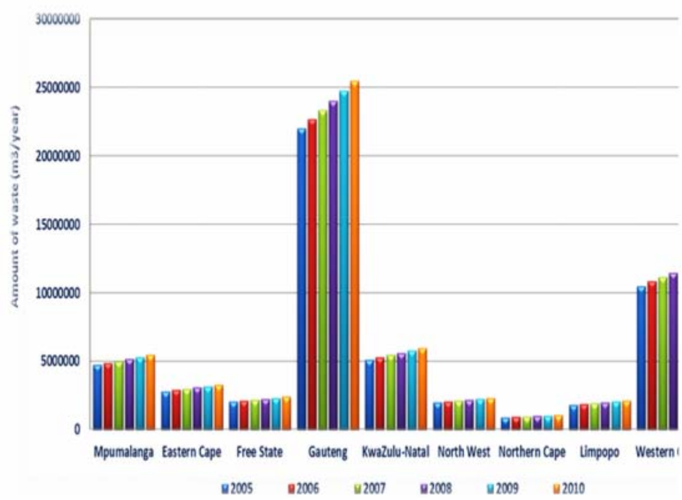

Fig. 1 Waste generated per province in South Africa [DWARF 1997]

Over the next 50 years, South Africa's population growth will be almost entirely concentrated in urban areas. If adequate waste management policies and practices are not implemented, cities will face serious waste challenges and this will affect the quality of life of its citizens. Household waste generation varies considerably by settlement type and income, with wealthier consumers in urban areas generating much higher waste volumes.

II. Waste Management

Historically, the initial focus of waste management was on "basic waste management" which is the cleansing function. This includes waste storage, collection, transport and environmentally acceptable disposal. Waste management in South Africa is based on the principles of the White Paper on Integrated Pollution and Waste Management (IP and WM), the National Waste Management Strategy (NWMS), (DEAT 1999 [5], 2000 [6] and as well as the New National Environmental Management Waste Act (2008) [7]. Integrated waste management became mandatory with the coming into effect of the National Environmental Management Waste Act, 2008 on 1 July 2009. In this approach to waste management, South Africa supports a waste hierarchy by promoting cleaner production, waste minimisation, reuse, recycling and waste

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treatment. Disposal and remediation are regarded as the last options in waste management as of 2010, Fig. 2.

The first choice of measures in the management of waste is waste avoidance and reduction. Where waste cannot be avoided, it should be recovered, reused, recycled and treated. The New National Environmental Management Waste Act (2008) and the NWMS provide additional measures for the remediation of contaminated land to protect human health and secure the wellbeing of the environment.

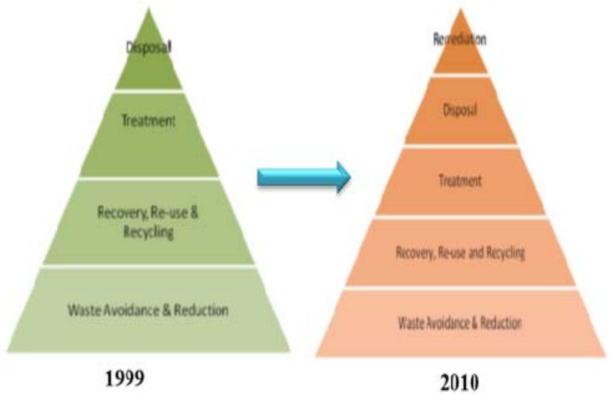

Fig. 2 Waste Hierarchy, NWMS 1999 and 2010, Savage 2009 [8]

A. Waste avoidance and reduction

Waste avoidance and reduction is the foundation of the waste hierarchy and is the preferred choice for waste management measures. The aim of waste avoidance and reduction is to achieve waste minimization and therefore reduce the amount of waste entering the waste stream. This is particularly important for some waste streams where the recycling, recovery, treatment or disposal of the waste is problematic.

B. Recovery, re-use and recycling

Recovery, re-use and recycling constitute the second step in the waste hierarchy. Recovery, reuse and recycling are very different physical processes, but have the same aim of reclaiming material from the waste stream and reducing the volume of waste generated that moves up the waste hierarchy. Section 17 of the Waste Act sets out standards regulating recovery, reuse and recycling and describes a range of additional regulatory measures available to the Minister in this respect. Recycling rates in South Africa are relatively well established, driven primarily by industry-led, voluntary initiatives with funds managed independently from the government via non-profit associations, which oversee recovery/recycling processes and facilities. Typical examples of recycling rates in South Africa are given in Table 1 [9].

TABLE I
RECYCLING RATES IN SOUTH AFRICA IN 2007

Recyclate	% Recycled in 2007
Metal beverage cans	70%
Paper	54.50%
Glass	25%
Plastics	22%

C. Storage, collection and transportation

The delivery of waste management service, including the storage, collection and transportation is the main point of interface between the public and waste service providers. The extent and form of provision of waste services to households and businesses also impacts directly on all stages of the waste hierarchy. The Waste Act requires municipalities to ensure access to and sustainability of waste services, to provide waste services at affordable prices, and to keep separate financial statements for waste services provided, amongst others. Waste management service is a core function of all metropolitan municipalities and most local municipalities, while district municipalities in general do not view waste management as part of their functions. The NWMS sets out a programme for universal provision of waste services according to standards developed in terms of the Waste Act. In order to achieve this, coordinated action by different spheres of government is required to address the fiscal and capacity problems faced in waste service provision.

D. Treatment and disposal

This is the final and least desirable step in the hierarchy involving landfilling of wastes as well the chemical and or physical treatment of waste. In South Africa, the treatment, processing and disposal of waste must take place in accordance with the principles of environmental justice and equitable access to environmental services as articulated in the National Environmental Management Act 107 of 1998 (NEMA).

This is particularly important in view of the fact that landfills and waste treatment facilities tend to be located in close proximity to poor communities and informal settlements. At present most collected waste is disposed in landfills. Within the landfills biodegradable waste produces methane, a powerful greenhouse gas. Plastic waste in particular is a challenge as it occupies valuable space in landfills and takes a long time to degrade. The number of legally designed landfill sites is indicative of a country's commitment to effectively manage the full range of waste produced. As indicated in the 1996 and 2001 census, municipal waste collection has improved, but more than 50 % of the population is not receiving a regular municipal waste collection service.

The metropolitan municipalities deliver almost 100% service, while the local municipalities in some cases deliver no service at all. General landfills sites accept domestic, commercial and industrial non-hazardous, building and garden waste. Most of the sites in South Africa are owned and operated by the local authorities. Well-designed landfill sites are important for effective waste disposal meeting legal requirements. Table 2 shows the number of legal landfill sites in South Africa per province as of 2010 [10]. Of the 817 landfills in South Africa, 20% are in Gauteng due to the high volumes of waste generated [11]. According to the DEAT

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(2005) census, of the 1 336 waste facilities, only 583 (43%) are legal as shown Table 3 [12].

TABLE II
LEGAL LANDFILL SITES IN SOUTH AFRICA BY PROVINCE [10]

Provinces	Legal landfills
Western Cape	97
Eastern Cape	120
Northern Cape	103
Free State	67
KwaZulu-Natal	119
North West	35
Gauteng	160
Mpumalanga	72
Limpopo	44
Total	817

TABLE III
WASTE MANAGEMENT FACILITIES PERMIT STATUS

Type of Landfills	Number of facilities	Number of Permitted facilities	Percentage of legal facilities
General Waste Landfill sites	1203	524	43.56
Hazardous Waste Landfill sites	77	41	53.25
Medical Waste storage facilities	12	4	33.33
Recycling facilities	9	2	22.22
Transfer stations	35	12	34.29
Total	1336	583	+

III. DRIVERS FOR WASTE MANAGEMENT TECHNIQUES

A. Increased demand for waste service provision

As a result of increased population growth as well as urban and industrial development, there is an increased demand for waste service provision such for storage, collection, handling transportation, treatment and disposal facilities and services [9].

B. Increased Demand for Waste Minimisation, Recycling and Recovery

In line with international norms, the National, Provincial and Local authorities, as well as communities and industry are encouraged by regulation to implement measures to economically reduce waste generation and disposal rates by adopting cleaner technologies, separation and reclamation/recycling of wastes among other strategies [9].

C. Land use, physical and environmental limitations

Limitations on the location and operation of waste management facilities include proximity to human settlements, topography, geology and hydrology. Facilities should be located in such a way that they pose minimum environmental risk but economical for waste transportation. Regional facilities serving larger population and industry groups are encouraged [9].

D. Socio-economic and demographic factors

Socio-economic and demographic factors such as urbanisation, unemployment and population growth impact on future waste trends and service provision. South Africa's growing population is characterized by both urbanisation and the rapid development of the African Middle class as historical injustices are redressed [9]. The increase in affluence increases the amount of waste generated and also leads to more complex waste flows. The growth in waste volumes was estimated to be at 67 million cubic metres in 2010 [13]. Rapid urban growth throughout the country seriously posses challenges for most cities to provide adequate waste services for their citizens. Household waste generation varies with settlement type and income with the wealthier population in urban areas generating more volumes of waste. Access to waste services remains highly skewed in favour of the more affluent and urban communities.

The implementation of effective waste management strategies will help in the development of an economically viable waste management sector which has an estimated total expenditure of approximately R10 billion per annum [13]. According to [8] both waste collection and the recycling industries make meaningful contributions towards job creation and GDP. The National Waste Management Strategy [8] states that – well considered, effective solid waste management systems can make critical contributions to public health, environmental sustainability, economic development and poverty alleviation by (i) improving public health outcomes (ii) enhancing environmental quality (iii) reducing waste quantity that can clog up public storm water and sanitation networks (iv) supporting higher levels of economic activity (v) contributing directly to poverty alleviation.

IV. RESEARCH AND TRAINING

The white paper on Integrated Pollution and Waste Management (IP and WM) (DEAT, 2000), recognizes the importance of scientific research. In particular the South African government will assist people to act in an informed manner by (i) promoting scientific research, monitoring and recognizing local knowledge and information (ii) ensuring a wide dissemination of research results as well as other pollution and waste management data (iii) encouraging access to information and legislation (iv) encouraging individuals and the communication media to act on the basis of sound information (v) giving attention to the environment at all levels of the formalised education system to ensure that all members of society obtain an understanding of the sources, the prevention and the minimisation of pollution and waste. Policy development and decision-making on pollution and waste management have to be supported by both applied and basic research.

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Edison Muzenda is an Associate Professor, Research and Postgraduate Coordinator as well as Head of the Environmental and Process Systems Engineering Research Group in the Department of Chemical Engineering at the University of Johannesburg. Professor Muzenda holds a BSc Hons (ZIM, **1994**) and a PhD in Chemical Engineering (Birmingham, **2000**). He has more than **15** years' experience in academia. Edison's teaching interests and experience are in unit operations, multi-stage separation processes, environmental engineering, chemical engineering thermodynamics, entrepreneurship skills, professional engineering skills, research methodology as well as process economics, management and optimization. He is a recipient of several awards and scholarships for academic excellence. His research interests are in waste water treatment, gas scrubbing, environment, waste minimization and utilization, energy as well as phase equilibrium measurement and computation. He has published more than **85** international peer reviewed and refereed scientific articles in journals, conferences and books. Edison has supervised over 18 postgraduate students as well as more than 130 Honours and BTech research students. He serves as reviewer for a number of reputable international conferences and journals. He has also chaired several sessions at International Conferences. Edison is an associate member of the Institution of Chemical Engineers (AMIChemE), member of the International Association of Engineers (IAENG); associate member of Water Institute of Southern Africa (WISA) and member of the International scientific committee of the World Academy of Science, Engineering and Technology (WASET) as well a member of the Scientific Technical Committee and Editorial Board of the Planetary Scientific Research Centre. Edison is recognized in Marquis Who's Who 2012 as Engineering Educator.

Freeman Ntuli holds a PhD in Chemical Engineering from the University of Cape Town. Currently, he is a Senior Lecturer in the Department of Chemical Engineering at the University of Johannesburg. His main areas of research are in hydrometallurgy, crystallization and environmental process engineering. His specific research activities involve gaseous reduction processes, leaching processes, reduction crystallization, modeling of particulate processes, wastewater characterization and treatment.

Dr. Ntuli has authored more than 35 articles in international scientific journals and conferences and a number of technical research reports to industry and is also actively involved in the supervision of postgraduate students. He is a member of the International Association of Engineers (IAENG), an associate member of the Institution of Chemical Engineers (IChemE) and currently serves as a member of the editorial board for the Environment and Pollution Journal and reviewer for the Environmental Science and Pollution Research journal.

Tsietsi Pilusa holds a Masters degree in Chemical Engineering from the University of Johannesburg. He has more than 7 years' experience, in mining, metallurgy and waste management industries. Currently, he is a Station Engineer in the Process, Energy and Environmental Technology Station at the University of Johannesburg. His main areas of research are in alternative fuels, waste to energy, environmental pollution and waste management. His research involves classifications of industrial wastes, energy recovery, beneficiations processes and energy utilization mechanisms.

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