

## RE – ENGINEERING OUR WASTE MANAGEMENT METHODS: A ROAD MAP TO SUSTAINABLE WASTE MANAGEMENT PRACTICE IN NIGERIA

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### **Abstract**

*The paper is geared towards finding solution to the irregular dumping of waste around the major, minor roads and streets of many cities in Nigeria. It also address among other things, sustainable waste management practice and its objectives, the different stages in effective waste management and disposal, problems associated with the methods of waste disposal in Nigeria, factors that limits sustainable waste management practice and the way forward. Also discussed in this paper are the roles of individuals, government, international and other organizations in ensuring that waste is properly disposed and effectively managed. It was proposed at the end of the investigation that for sustainable waste management to be effectively established, people must change their attitude, they must respect laws and regulations guarding irregular waste disposal. Finally, they must understand the concept of waste reduction at source as the most effective method of managing waste.*

**Keywords:** Waste, waste disposal, waste management, landfill, recycling and sanitation.

### 1.0 INTRODUCTION

Nigeria is currently put at an estimated population of 140 million people with majority of the people residing in towns, cities and generating solid waste of different kinds without devising a suitable method to effectively dispose of them. The problems of irregular solid waste disposal are causing a major threat to life in all the cities<sup>(1)</sup>. Solid waste disposal has reached a level where solution seems out of reach. Major roads, streets, schools, hospitals and market places have suddenly become a common site for dumping of all kinds of domestic and commercial solid waste. Waste has formed mountains and heaps at every open and spot of all major towns and cities in Nigeria. The effect is that drainage system, major and minor roads, even street, either get completely or partially blocked, thus impeding the smooth flow of traffic and also causing

uncontrolled erosion problems<sup>(2)</sup>. More importantly, they constitute “eye sores” destroying the aesthetics and beauty of our societies. In addition, the dumped site normally serves as breeding grounds for rodents, pathogens and flies, thus constituting a major threat to the health of the citizenry<sup>(3)</sup>. This results among others to epidemics and disease outbreak, emission of obnoxious and offensive odour, flooding of towns and cities and clogging of the drainage channels and systems. Beyond the domestic wastes that are generated from our daily activities, several industries in the country produce different kinds of waste from their daily activities and operations. Industries and institutions including Breweries, Pharmaceuticals, Hospital, Refineries, Fertilizer plants, Pesticides, Insecticides, Resins, Paints, Vanishes, Plastic, Soap, Cleaning agents and perfumes

Manufacturers, Oil exploration and production companies, Food processing companies etc. are massive waste generators. They all, on daily basis generate tonnes and tonnes of different types of solid, liquid waste and gaseous emission, that are discharged into the environment. While some immense efforts to responsibly dispose of their wastes are shown by some of the companies, others are yet to start, pretending to be unaware of their actions and what to do. Atmospheric emission of waste into our immediate environment through gas flaring, indiscriminate burning of waste dumps and chemicals, release of ozone depleting substance and green house gases, emission from vehicles and generators and several other machines are alarming. All these influence the chemistry of the atmosphere and cause imbalance, and could constitute threat to life <sup>(4)</sup>. In this paper, the concept of waste, that is, the meaning and types of waste are discussed. Also discussed is the concept of sustainable waste management; which embraces objectives of sustainable waste management, an over view of waste management in Nigeria prospects and challenges. This also involves the study of various techniques for sustainable waste management practices, challenges to sustainable waste management and the way forward coupled with the global concepts of waste management and the role of government, individual and other stake holders towards ensuring sustainable waste management practices.

## **2.0 THE CONCEPT OF WASTE: MEANING AND TYPES**

### **2.1 Meaning**

Waste can be described, as anything for which there is no further use

or market value. Waste can also be referred to as anything that is intended to be discarded, disposed of or get rid of by the initial holder. Waste is by itself a nuisance and a hazard to life as well as a risk to public health. The hazardous effect of solid waste becomes even more when it is not properly managed and disposed <sup>(6)</sup>. Therefore waste management becomes a vital issue as far as public health and environment is concerned. Waste management therefore refers to the proper management of waste and the effective disposal of the waste so that it does not pose any threat to human life.

### **2.2 Types of Waste**

Waste can be subdivided depending on their mode of generation <sup>(7)</sup>:

- ❖ Domestic Waste: They include; food waste, garbage, cloths, papers, glass, metals wood plastics and rags),
- ❖ Agricultural waste: they include; cassava peels, cut weeds, dead animal's poultry dumping organic manures and cow dung's.
- ❖ Industrial Waste: Waste generated from, industrial setups such as (Batteries, waste oil and drill cuttings).
- ❖ Commercial Waste: Waste generated as a result of commercial activities such as papers, clothing, leathers, and rubbers.
- ❖ Special Waste: These are hazardous waste that requires special treatment and handling. Example of waste in this category include; chemical waste, toxic waste and nuclear waste.

### **3.0 STAGES IN WASTE MANAGEMENT AND DISPOSAL**

The series of operations involved in the effective management of solid waste are as follows:

#### **❖ Generation Of The Waste:**

Waste generation can either be from domestic source, Agricultural, commercial, industrial and Nuclear.

#### **❖ Waste Storage**

After the waste has being generated, the next stage is to store them. Waste is normally stored using Bins such as small bins, big bins and the dinosaur.

#### **❖ Collection**

After storage, the waste are then collected to a central location called the transfer station, thereafter they are sorted depending on their nature and types: followed by treatment. Treatment methods usually employed include: baling, shredding, composting, pyrolysis, incineration, bio-stabilization, bio-oxidation and compaction

#### **❖ Disposal**

Three basic methods of disposal are available for waste management, they are: Open dumping, ocean dumping and Burial [Landfill].

### **4.0 WASTE MANAGEMENT PRACTICE IN NIGERIA "AN OVERVIEW"**

As a result of the health threat posed by the unguarded solid waste sites, the Federal Government of Nigeria decides to establish the monthly Environmental Sanitation Day Exercise (ESDE), in which at every last Saturday of every month between the hours of 7:00 and 10:00am people are expected to keep their immediate environment clean. Though ESDE has helped to some

reasonable degree at ensuring that our environment are kept clean and free of waste dumps, but on the long run the programme has failed to realize the main purpose for which it was designed <sup>(2)</sup>. The reasons for this are analyzed below:

❖ Waste collected during the sanitation Day are at best dumped in yet unauthorized dump site and often left along streets and roadsides until the next environmental day exercise. By this time, large proportion of the waste would have been blown back into circulation by wind or worse still, washed into drains that empty into water ways and rivers forming a close loop of (source – pathway collector – back to source).

❖ Waste management ought to be a routine exercise. The monthly environmental sanitation exercise allows for too much waste to be dumped on roads and streets with the intention that it will be removed during the next sanitation exercise. This practice will not allow for effective and proper disposal / management of the waste.

❖ The sanitation exercise is susceptible to weather changes as the exercise is likely to be cancelled any time there is a heavy downpour on sanitation day. It is on this premise that the authors decide to x-ray the possibilities of achieving an effective sustainable waste management practice that will not only consider the present situation but will also take absolute care of the future.

## **5.0 SUSTAINABLE WASTE MANAGEMENT:**

Sustainability is a concept that takes absolute care of the future without causing any permanent alteration or change to the present built environment. Sustainable waste management practice is a look into the future; it is a practice that takes into utmost consideration the long term effects of unguarded dumping of waste in our immediate environment. It is a measure aimed at controlling the way waste are managed and disposed; it is a continuous practice and must know no end since waste is a thing that is continuously generated. Sustainable waste management takes into consideration the possibility of generating a certain amount of raw materials from waste. It is absolute compliance with environmental rules and regulations <sup>(8)</sup>.

### **5.1 Objectives of Sustainable Waste Management**

Sustainable waste management is now a multidisciplinary issue involving the people themselves, engineering economist, urban and regional planners and all other stakeholders. Its objectives are as follows: Reduction in waste quantities, Reduction in raw materials consumption, Reduction in the cost of waste treatment, Maintenance of the quality of air / environment, Protection of human health, Effective management of natural resources, Compliance with international waste management rules and regulations and to serve as an indicator for effective environmental management with the view to minimize environmental pollution problems.

## **5.2 Sustainable Waste Management Techniques**

Waste management in Nigeria as a matter of urgency needs attention. Possibly because it falls below international standards or because it has not yielded any noticeable positive results as far as management of waste is concerned. There are however, elements of waste management within some companies in Nigeria. Example is the SPDC waste management techniques. For sustainable waste management to be achieved in Nigeria, the following techniques will be of immense importance <sup>(1)</sup>.

### **❖ Creation of Recycling Centers**

Domestic wastes such as paper, plastics, packaging materials, metals can be recycled and turn into useful raw materials rather than allowing them to litter the roads and streets. The recycling process will also reduce the cost of industrial production (as recycled products are cheaper though less durable) and in turn, reduce the amount of waste injected into the environment <sup>(1)</sup>.

### **❖ Design of Sanitary Landfills**

Landfill is the cheapest and most convenient method of waste disposal, only if economic land is within the range of the source of waste. It is highly convenient and neat; capable of eliminating the possibility of obnoxious smell and minimal health threat. Government and industries should try as much as possible to establish sanitary landfill in all heavily populated towns, cities and industrialized areas. A sanitary landfill is an effective design where waste are disposed of and eventually buried. The base is normally lined with a layer of concrete or cover

crops to avoid washing away of the waste during the active stage of landfill decomposition<sup>(5)</sup>

#### ❖ **Creation Of Functional Waste Collection Structures**

As a way forward, government across the nation, must set up new or strengthen existing waste management authorities or bodies charged with the proper collection of waste as a way of making them more viable and more effective. More also, such bodies should be run as autonomous companies, self financing, without government interference. This will not only address the problems of inadequate waste collection scheme, it will also provide employment opportunities for the teaming youths. The work could be made easier by creating waste collection points in every strategic location within the cities. A supervisor must be placed at this point having a mini office where he can stay and write a day – to – day report on the progress of such center. A collation office must also be created where the data can be properly assessed and appropriate actions taken.<sup>(3)</sup>

#### ❖ **Creation Of Incineration Points**

At least one or two incineration point is needed within a city, where non decomposable wastes can be completely burnt. Though the cost of designing an incinerator is very high, but the health implications of unguarded waste outweigh the cost of building at least ten incinerators.<sup>(1)</sup>

#### ❖ **Waste Monitoring Team**

For any law to hold in Nigeria, people must be there to enforce it. A waste management enforcement team must be put in place. This team must work in

collaboration with the Nigeria armed forces for it to be effective. It should be special squads charged with the responsibility of monitoring the way wastes are being disposed of by people. Backed by law, they may arrest anybody who violates the regulation of disposing waste properly. Several common policies can be found in all the strategies: they are

- ❖ commitment to meet the requirements of the Landfill Directive
- ❖ necessity for improvement in markets for waste products, to enable an increase in materials recycling
- ❖ requirement to deal with the acknowledged growth in waste arising
- ❖ need to acknowledge the scale of the problem in each place and review current waste management regimes
- ❖ waste management options are to provide a balance of how waste is managed
- ❖ waste minimization and reduction of waste is vital
- ❖ Encouragement of a partnership approach between all stakeholders.

#### 5.3.1 **Draw Back To Sustainable Waste Management**

Some of the drawbacks to sustainable waste management practice are as follows:

- ❖ Availability of adequate land for use as dumpsite and landfill: Owing to the high population density in most urban areas, there

- ❖ Cost of constructing a recycling plant: Recycling plants especially those for plastics and metals are usually very expensive to construct.
- ❖ Cost of maintaining waste collection centers: Waste collection centers need to be continually maintained else they will be serving as breeding ground for pathogens which may further lead to disease outbreak.
- ❖ Design and construction of an incineration plant is usually capital intensive.

#### 5.4 The Way Forward

- ❖ Dumpsite and landfill can be placed at the outskirts of the city, waste bins of very high carrying capacity are then placed at strategic positions inside the city, with vehicles provided to lift the waste from the various bins at regular intervals.
- ❖ Waste collectors must be provided with all the necessary materials including vehicles and other vital instruments that may be required.
- ❖ Mapping and scheduling are two very important things that must be taken care of if effective waste collection can be achieved. The towns and cities must be well mapped, to avoid interference, schedule for collection must also be well designed to ensure that waste are collected as and when due.
- ❖ Government must solicit the efforts of private individuals, international organizations and other non-governmental agencies to assist in the acquisition and construction of

incineration and waste recycling plants.

- ❖ Individuals must understand that the practice of waste reduction at source is the best practice in sustainable waste management and must be taken very seriously.

### 6.0 GLOBAL CONCEPT OF WASTE MANAGEMENT

Waste management techniques have suddenly become a global issue, which requires suggestions and contributions from different sources, individual, government and non-governmental organizations alike. Globally, waste management is a systematic process that includes all waste streams inventorisation, quantification and categorization. It involves the utilization of the Big Four strategies namely: reduction of waste, reuse of waste, recycling of waste and recovery of useful materials from waste.

#### 6.1 The Big Four Strategies

##### ❖ Reduce

This involves the generation of less waste through more efficient practices; examples of such efficient practices include material elimination or substitution, process modification and improved house keeping. These practices are aimed at reducing waste at source <sup>(1)</sup>.

##### ❖ Reuse

Reusing waste involves the voluntary or continued use of a product for the purpose for which it may not have been originally intended, such as the reuse of coffee cans for holding nails or it may be the extended use of a product such as retreading automobile tires. Other practices aimed at reusing waste include: burning of waste oil



for energy generation, reusing chemical containers and using oily waste materials for road construction <sup>(1)</sup>.

❖ **Recycle**

The process involve in the conversion of waste into usable form is termed recycling. Examples include the recycling of waste paper to produce tissue papers, production of glass from feedstock containing waste glass and the use of recycled plastic waste for the production of plastic materials <sup>(1)</sup>.

❖ **Recovery**

This involves obtaining or extracting usable product from waste. Recovery differs from recycling; recycling is a mechanical process involving the use of a recycling plant where as recovery is a physical process which does not require machine <sup>(2)</sup>.

**6.2 Waste Tracking**

This is the process of monitoring waste from the beginning to the end. The global concept of waste tracking says that every company and individual will be held responsible for the waste they generate. It means therefore that he who generates waste must be responsible for the management and disposal. Therefore, we have a responsibility to track the movement of the waste we generate.

**6.3 Proximity Principle**

The Proximity Principle is an important factor in the assessment of waste disposal. Waste should be disposed of as close to its source as possible. This reduces time, energy, the possibility of accident and the expense of long distance transport, all of which may eventually outweigh the benefits of options such as recycling or composting. The proximity

principle also alerts waste producers and the general public to factors concerning quantity and disposal, which in turn encourages waste reduction.

**6.4 Integrated Waste Management**

The integrated waste management model looks at the life cycle of municipal solid waste, from the moment it becomes waste (loses value) until it ceases to be waste by becoming a useful product. The inputs for an integrated waste management system are waste, energy and other raw materials. The outputs from the system are useful products in the form of reclaimed materials, compost, emissions to air and water and residual landfill material. A parallel model calculates the overall costs of the integrated waste management system based on local cost data. Once the waste management system has been described, the inputs and outputs of each chosen treatment process must be calculated, using fixed data for each process. Results are expressed as: net energy consumption, air emissions, water emissions, landfill volume, recovered materials and compost produced <sup>[9]</sup>. [Fig 1 and 2]

**6.5 Use of International Protocols and Convention**

Waste which are usually very difficult to manage because they are either very persistent in the environment or could constitute real nuisance when released into the environment, are normally controlled by using international protocols. Example of such waste include refrigerant such as R12 (CFCs) having very high ozone depletion potentials. Some common international protocols are the Montreal Protocol aimed at banning substances with potentials to deplete the ozone layer <sup>(4)</sup>.

## **7.0 Ensuring Sustainable Waste Management Policies**

Ensuring an effective sustainable waste management practice demands the combined efforts of government, international and non-governmental organizations and even the local communities. Waste management need to be seen as an integral part of the economy and viewed as a whole with sustainable consumption and production. Adopting of an integrated approach to waste management can also be seen as a good option, in which case waste management can be considered to be a number of key elements working in concert, and recognizing each step in the waste management process as part of a whole. More also, the collection, transport, sorting, processing and recovery or disposal of wastes; must be a holistic approach and must work together that is, involvement of all key players. An integrated approach to waste management should also define the contributions which all interested parties (which might include waste producers and managers, waste re-processors, waste regulators, waste management planners, community groups, consumers and householders, and government) can work together towards the achievement of a common goals and objectives. Government owes it as a point of duty to provide an effective waste monitoring team coupled with financial assistance in construction of recycling plants plus incinerators <sup>(4)</sup>.

## **8.0 Conclusion**

Sustainable waste management, if effectively practiced will ensure complete management and proper disposal of waste

generated by individuals and companies. The practice will not only eliminate the out break of disease caused by unguarded waste dumps, it will also reduce cost of raw materials as waste will be properly recycled and thereafter reused. The long term benefit of this is the effective utilization of raw materials. Sustainable waste management will also bring about a healthy environment since all the waste will be effectively managed and properly disposed.

## **9.0 Recommendations**

The following recommendations will be very useful in management of solid waste:

1. The practice of waste reduction at source must be taken very seriously. In which case individuals should try as much as possible to reduce the amount of waste they generate.
2. A functional waste collection scheme must be put in place as a matter of urgency. The waste collection team must be highly equipped with all necessary equipments and machine needed for proper waste collection.
3. Individuals also need to change their attitude as to the way they handle their waste. It is note that the way you store your waste determines how it will be collected. Thus individuals must learn to store their waste properly.

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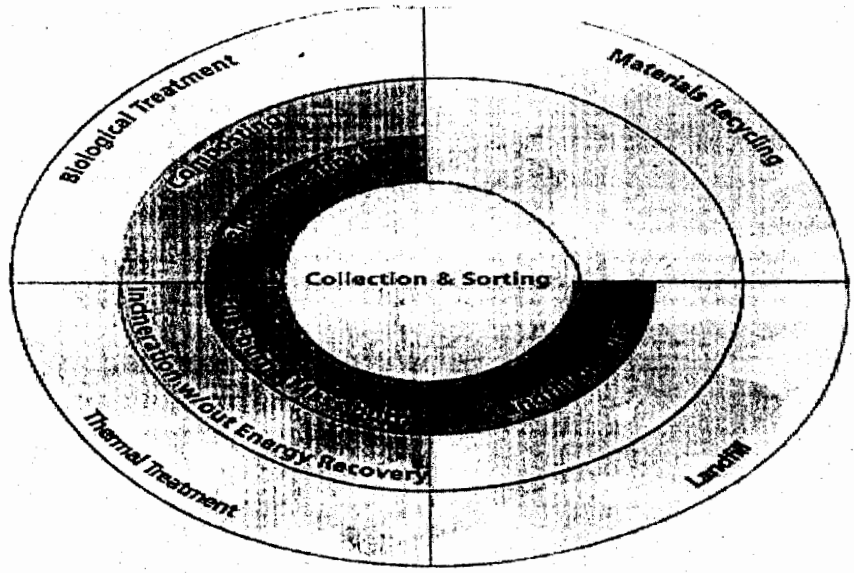
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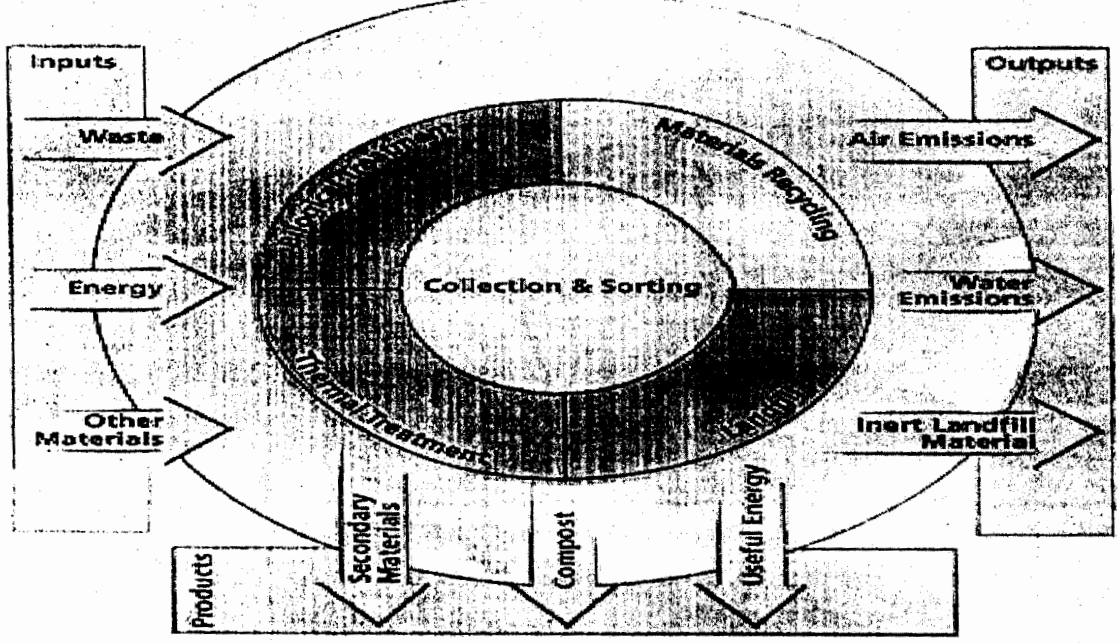
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FIG 1: THE BASIC ELEMENTS OF AN INTEGRATED WASTE MANAGEMENT SYSTEM

The Elements of Integrated Waste Management



System boundaries for the environmental life cycle inventory of solid waste



Reference: McDougall, F., and Fonteyne, J. (1999)