

Full Length Research Paper

Landfill development and current practices in Lagos metropolis, Nigeria

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The disposal of solid wastes to land is the ultimate end-point for any waste management system. However, waste landfills should be set up and operated properly in order to minimise the risks posed to health and the environment. This review provides an insight into landfill operations and management in Lagos, Nigeria. Secondary data and *in-situ* observations at the landfill sites were used. Results show that landfills within Lagos metropolis are uncontrolled and do not conform to international standards of similar operations elsewhere in the world. This non-compliance result into a proliferation of insects and rodents which allows blowing of litter that causes bad odour and general environmental degradation. These negative impacts can only be minimized by pragmatic design and proper management of landfills within urban and peri-urban areas.

Key words: Waste management, landfills, leachates, environmental degradation, urban areas.

INTRODUCTION

Waste management has been identified as one of the most challenging environmental problems facing cities in most developing countries (Bartone et al., 1990). Disposal of waste is a challenge for many communities in both the developed and developing countries because of the risks to human health and the general environment (Olorunfemi, 2011, 2009). Many of the current problems associated with waste management have come from increased waste generation resulting from increasing urban population. There is need for these wastes to be properly and safely disposed to minimize environment damage. In Nigeria, the situation has worsened mainly because of the spate of industrial developments, coupled with rapid human population growth in the most urban areas. Hence, there is need for effective waste management strategies relevant for this part of the world. Uncontrolled widespread dumping of wastes on urban land has serious implications for land and the environment in the vicinity of such sites. Associated with management of waste is the siting of waste disposal facilities which is a central issue in waste management. Among these facilities are landfills and waste and sewage treatment plants and incinerators, among others. However, landfill has been recommended as the best facility for handling waste in developing countries (Ziess and Atwater, 1987). Allaby (1988) defined Landfill as the

disposal of refuse by tipping it on land. He further observed that a landfill qualifies as controlled when refuse is deposited in a prepared site over which earth can be heaped at the end of each day.

For a long time, there has been a public view that landfills are not favorable usage of land (Smith and Desvougues, 1986; Carter, 1989). As a noxious facility, it is generally perceived as risky because of the inherent negative externalities associated with it. Landfills are commonly considered as a form of nuisance and are classified under environmental features which are risky and can reduce land and house values (Nelson et al., 1992, Olorunfemi, 2004). For example, Zeiss and Atwater (1987) disaggregated these impacts as physical (environmental change); social (stigma to the image of the host community); political (unfairness to the host community); and economic (property value depreciation). In developed countries, these impacts, being borne by the host community on behalf of the larger society, are sometimes calculated and adequately compensated for to ease decision-making. However, this is not the case in developing countries where not much is known about the nature of the impact of landfills on society and the environment and where there is little or no public consultation on landfill siting processes.

Providing adequate disposal facilities is a challenge

Table 1. Estimated and projected volumes of solid waste generation in some Nigerian cities for the period 1982 to 2000.

Urban area	1982	1985	1990	2000
	Tonnes per year			
Lagos	625,399	681,394	786,079	998,081
Ibadan	350,823	382,224	440,956	559,882
Kano	319,935	348,580	402,133	535,186
Kaduna	257,837	280,295	324,084	431,314
Onitsha	242,240	263,929	304,477	386,593
Port-Harcourt	210,934	229,821	265,129	352,853
Osogbo	131,903	143,712	169,719	236,703
Aba	122,923	138,786	142,609	213,552
Jos	99,871	111,905	134,272	197,660
Warri	67,477	75,607	91,396	133,531
Gusau	44,488	48,471	57,243	79,835
Potiskum	15,434	16,816	19,399	28,347
Uyo	12,508	13,628	15,721	20,923
Suleja	9,383	10,514	13,311	21,336
New Bussa	5,690	6,200	7,152	9,518

Source: Nwabugwu (2001).

faced by waste managers throughout the world. Often, lack of such facilities is just one of a number of related deficiencies to be overcome in solid waste management (Rushbrook and Pugh, 1999). Globalization, rapid urbanization and economic growth in the developing world tends to deteriorate this situation further. Hence, a legitimate question arises: How can we deal with solid wastes in an efficient, effective and sustainable manner? Current approaches to solid waste management are by and large, unsustainable (Van de Klundert and Anschutz, 2000).

Faced with the rapidly increasing problems of waste management in Nigerian cities, there is need to embark on practical programmes to deal with the situation. Use of landfills is one of the oldest practices used by man, with the aim of achieving sustainability in overall waste management. Within the context of integrated sustainable waste management, proper landfill design, operations and management are quite important. It is in light of this that this paper provides a review of landfill practices in Lagos metropolis.

THE BURDEN OF SOLID WASTE IN LAGOS METROPOLIS

Lagos is a socially heterogeneous city with large variations in environmental quality. Solid waste is one of the biggest environmental problems that have for a long time bothered Lagos metropolis, as has been the case in many other Nigerian urban centers (Adedibu, 1983; Faniran, 1982; FME, 1982) (Table 1). There is a constant upswing in the annual volume of solid waste generated in

various municipal areas in the country. However, Lagos is in the lead in the amount of solid waste generated yearly in the whole of Nigeria. Reflecting on the factors of solid waste generation, particularly in Lagos, Saka (1997) observed that in Lagos State, the waste management problem did not become a noticeable problem until the early 1970s when the oil-boom era set in, bringing along with it mass importation of manufactured and industrial goods and a conspicuous change in the pattern of consumption and standard of living of urbanized Nigerians. This era also witnessed the mass influx of people from the less developed parts of Nigeria and many other countries in West Africa to Lagos. Consequently, there was a geometric increase in the daily tonnage of waste generated in Lagos, compared with all the other urban areas in Nigeria.

It is worth noting that waste generation is still on the increase in Lagos, thereby further compounding the waste disposal problems and the concomitant pressure on existing landfills.

LANDFILL DEVELOPMENT, OPERATIONS AND MANAGEMENT IN LAGOS METROPOLIS

Landfill development in Lagos State

At the inception of the Lagos Waste Management Authority (LAWMA) as Lagos State Refuse Disposal Board in 1977, there were five existing Landfill or dumpsites within Lagos metropolis, namely;

1. Pelewura (Adeniji Adele) Lagos Island Local

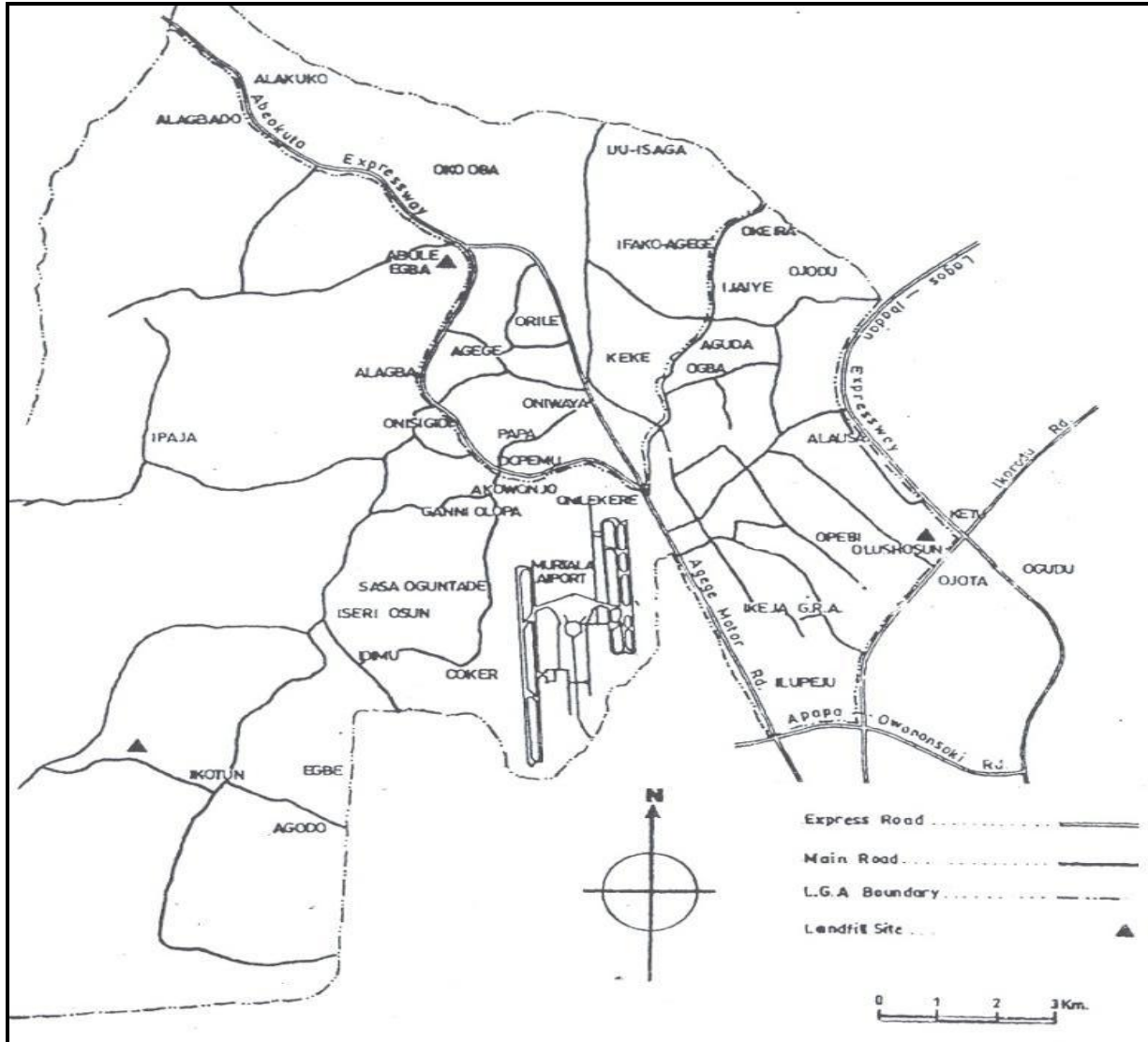


Figure 1. Map of Lagos showing the location of the landfills.

Government area

2. Gbagada (Kosofe Local Government area)
3. Isolo (Oshodi-Isolo Local Government Area)
4. Achakpo (Ajeromi-Ifelodun Local Government area)
5. Ojota (Odo-Iya-Alaro Local Government area)

These sites were open swamps progressively reclaimed with refuse. At that time, the environmental implications of waste management activities on these sites were of secondary importance to the waste being disposed (Adebisi, 2000). The five sites have, however, been closed to waste operations as far back as 1996.

In recognition of the prime position of Landfill as the final waste disposal means in solid waste management, earth-moving equipment such as bulldozers, excavators etc. were procured by LAWMA for Sanitary Landfill Practice under the World Bank-assisted project in 1988.

The package also included the development of Sanitary landfill Infrastructural Facilities to enable LAWMA fulfill its waste management disposal functions. Equipment delivery and site development commenced in 1988 and were completed in 1992. Consequently, three sites were proposed for sanitary landfill development in Lagos State:

1. Olushosun (42 ha) in the Ikeja Local Government area is located at the Northern part of the State.
2. Abule-Egba (10.5 ha) in the Alimosho Local Government area is located at the North Western part of the State.
3. Solous (3.0 ha) in the Alimosho Local Government area is located at the South Western part of the State.

Figure 1 is a map of Lagos showing the location of the landfills. Presently, two new landfill sites are being

developed, one at Epe and the other one at Ibafo, a Lagos suburb in Ogun State. While the former is being wholly developed by the Lagos State Government, the latter is being jointly developed by the Federal Government, Ogun State and Lagos State Governments (The Punch, 2006).

Landfill operations

Ideally, the Lagos City Authority operates on the three landfill sites aforementioned, but due to the low availability of bulldozers and other earth-moving equipment, only two of these sites are maximally operated. Presently, more than two-thirds of the municipal waste collected in the State is disposed of at the Olushosun and Abule-Egba landfill sites (Adebisi, 2000).

Olushosun site status

The site is about 42 ha, with a life span of 35 years from the date of its establishment in 1992. It is designed for operations as a sanitary landfill. It receives an average of 1,000,000 tonnes of waste annually. Sufficient cover materials for the waste are also available. However, due to lack of necessary earth-moving equipment, the wastes deposited are not covered on a daily basis (once in three months or more). The leachate produced from the site is ponded at the lowest level of the void space and is often re-circulated so as to reduce groundwater contamination and increase microbial load for waste decomposition.

Proper monitoring programmes for leachates, surface water, groundwater and landfill gas control are therefore important and necessary. Studies have shown that the soils at the site are lateritic in nature and provide a natural attenuation for water percolation (Adebisi, 2000).

Abule Egba site status

The site is about 10.5 ha with a lifespan of about 25 years from date of its establishment in 1992. It receives 250,000 tonnes of waste annually. Unlike the Olushosun landfill site, there are no sufficient cover materials in this site. As a result, wastes dumped into this site are sometimes not covered at all. This has increased the amount of odour and the number of flies within the area. There is no provision for ponding the leachate generated from the site and therefore, groundwater contamination is inevitable.

State government financial input on landfill sites

The State Government expended over half a billion Naira on development works on the two landfill sites. The

development works included, amongst others, construction of all weather access roads, fencing, site office and power installation etc. The construction works are of immense operational advantages to sanitary landfill practice as indicated in the following:

1. Improvement in operations techniques, that is, ramp and trench methods of landfill operations to ensure ease of maneuvering;
2. Reduction in turn-around time of collection vehicles and subsequent improvement in the efficiency of waste collection;
3. Perimeter fencing will prevent windblown litter and provide screen for the site, thereby improving the site's environmental aesthetics;
4. There will be improvement in waste harmonization existing presently at Olushosun site to accommodate co-disposal of other biodegradable non-toxic wastes from industries.

Locational characteristics of the landfills

The Olushosun landfill site is located at an excavated site North of Lagos metropolis in Ojota along the Lagos-Ibadan express way. The wastes brought from different parts of Lagos are dumped in the site to progressively fill up the depression. This site receives far more wastes than any other landfill in Lagos. Apart from the Olushosun village, which shares a boundary with the site, all the other surrounding landfills are well over 200 m from the site. The communities that are within 3 km of the site are Ojota, Ketu, Bashorun Abiola Garden and Oregon. These are mostly middle-density residential areas, with pockets of low and high-density residential areas.

The Abule Egba landfill is located along the Oshodi-Sango road within a residential neighbourhood. The Oko-Oba market also shares a boundary with the site. This is contrary to international regulations which require that buffer zones should be provided between landfill sites and surrounding properties. Unlike the Olushosun landfill, the management of the site is poor. Wastes are indiscriminately dumped along the road and these mostly include wastes from markets. However, recently, an access road was constructed for vehicles and cart pushers to dump their wastes. The locational characteristics of the landfills are shown in Table 2.

Figures 2 and 3 are maps of the Olushosun and Abule-Egba landfills, respectively, showing the land uses around the sites.

Operation and management of the landfill sites

The Lagos State Waste Management Authority (LAWMA) is responsible for the management of the landfills in Lagos. Management of landfills is expected to conform to

Table 2. Locational characteristics of the landfills.

Property	Olushosun	Abule Egba
Size (Ha)	42.7	10
Shape	Hexagonal	Rectangular
Depth (m)	18	8
Width (m)	800	150
Topography	Sited on an Excavated land	Plain surface
Drainage and runoff characteristics	Well drained	Drainage not very good
Nature of soil surface	Lateritic	Lateritic
Sub-soil and bedrock characteristics	Laterite-based	Laterite-based

Source: Author's Field work.

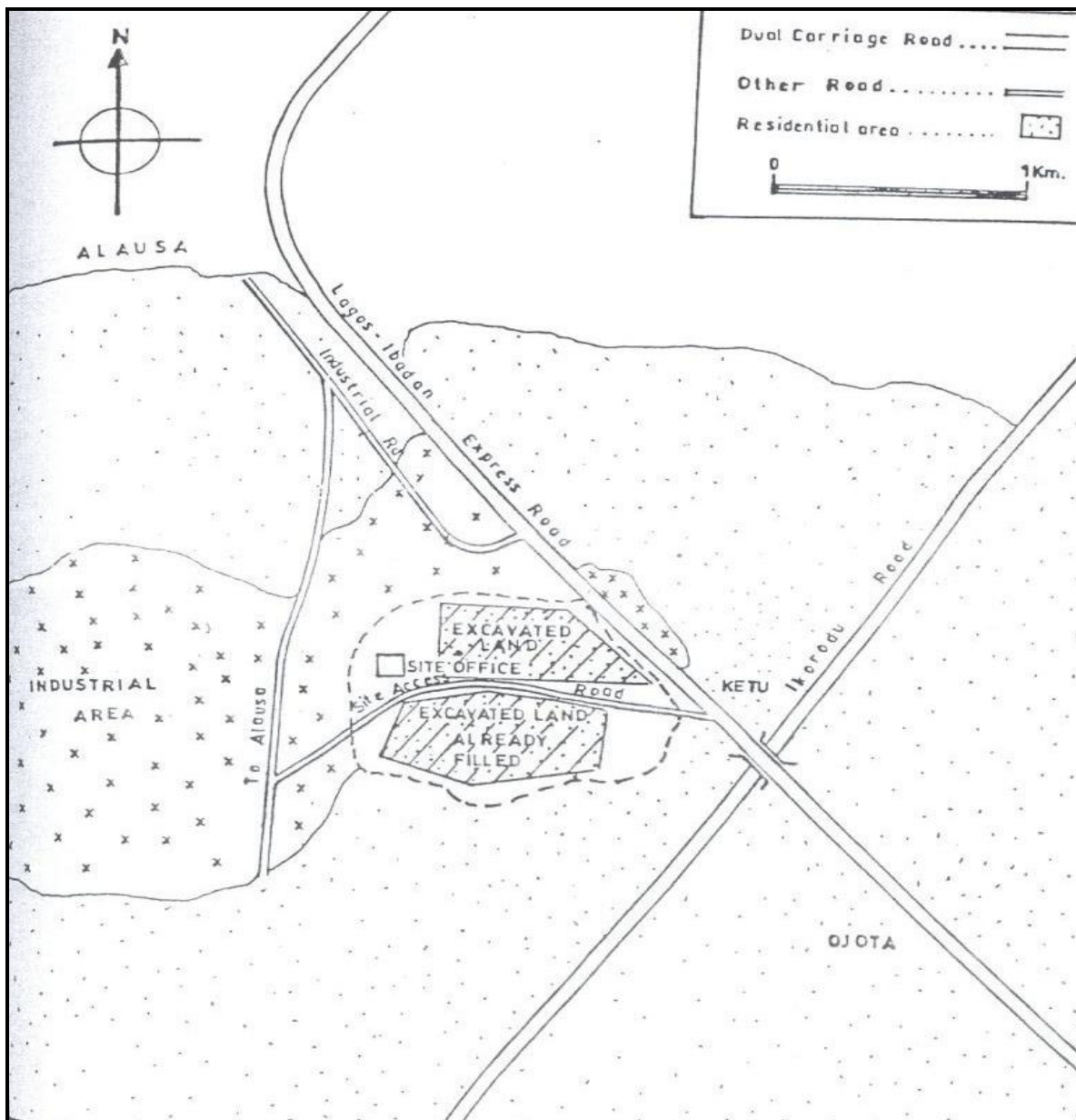


Figure 2. Location of Olushosun landfill showing land uses around the site.

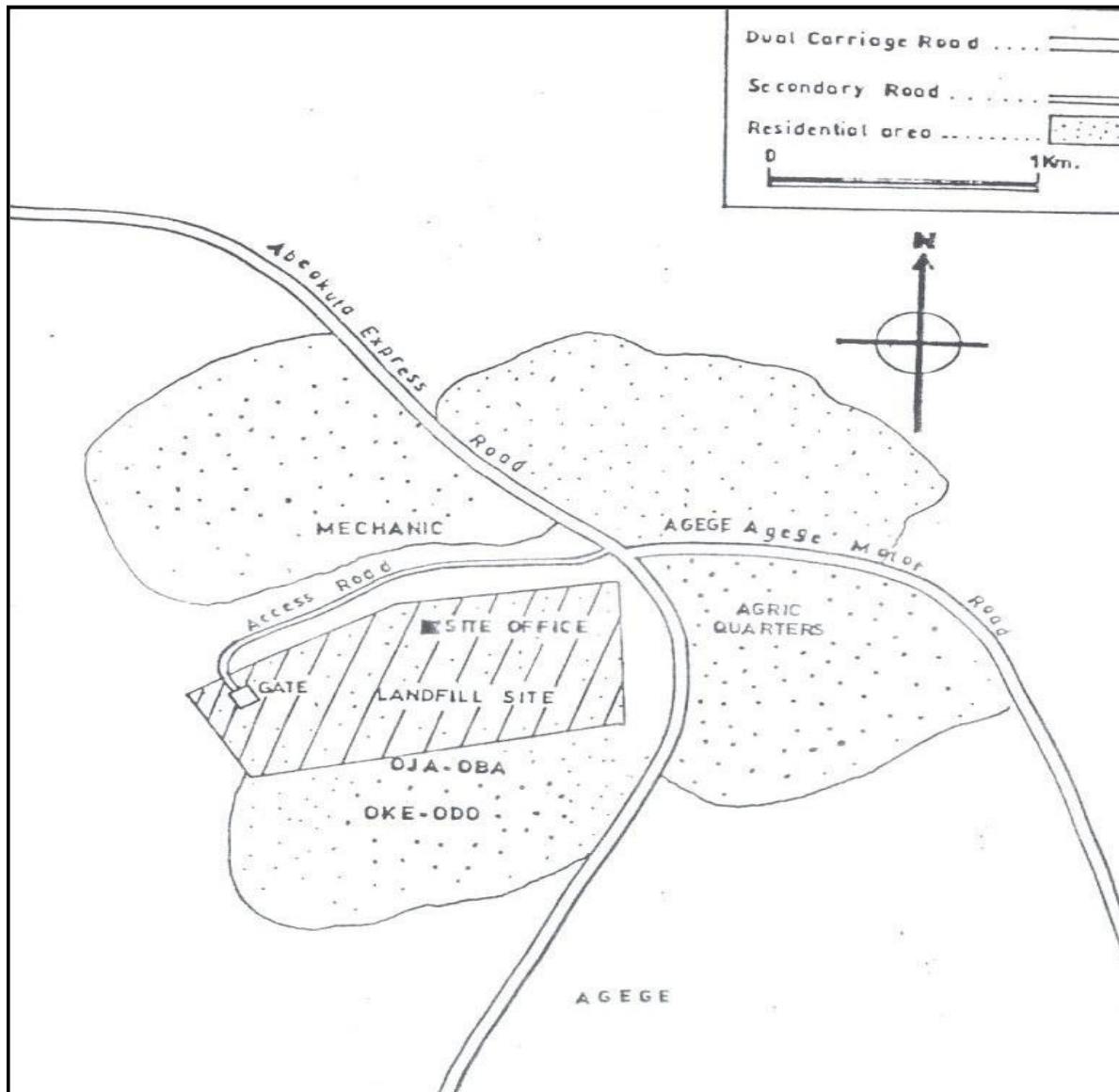


Figure 3. Location of Abule-Egba landfill showing land uses around the site.

international standards so as to reduce their adverse impacts on the communities. According to Lee and Jones-Lee (1996), the difference between a landfill and a waste dump is that in a landfill, each day's wastes are supposed to be covered by a few centimeters of soil. This soil layer reduces the odourous emissions associated with previously deposited waste. The soil layer also reduces, to some extent, the ability of vermins such as birds and rodents and disease vectors such as birds, rodents, insects (flies) etc. to access the waste. A number of visits to the landfill sites and interviews with LAWMA officials revealed that this practice is not yet in place as a result of financial and technical problems. Furthermore, it was revealed that the Abule Egba landfill is designated for use mostly by private refuse collectors.

It then becomes obvious that management practices at the site are very poor. The practice of refuse burning is still prominent at the two sites. In fact, smoke is among the major complaints by some residents interviewed. The activities of human scavengers are very prominent at the Abule Egba landfill site. Sometimes these scavengers persuade the cart pushers to dispose their wastes nearby for them to scavenge for usable materials in the waste. This has worsened the aesthetics problems derived from the siting and operation of the landfills. However, some steps have been taken by LAWMA to reduce the impact of the Olushosun landfill. These include spraying with different chemicals to reduce odour and insects as well as pests at the site, among others. There are personnel at the site who monitor the dumping of refuse and also

Table 3. Available facilities and labour at the landfill sites.

Property	Olushosun	Abule Egba
Capacity (Tonnes annually)	1,000,000	250,0000
Type and number of facilities	3 CAT Bulldozers 1 Cat 215 Excavator 1 CAT 950 pay loader	1 FIAT ALLIS Pay loaders
Volume of waste received daily (Metric tones)	5,000	850
Number of staff at the landfill sites	26	11

Source: Author's Field work.

keep the operations' reports. Table 3 shows some of the available facilities and labour at the landfill sites.

Discussions with key LAWMA officials revealed that these facilities and the number of personnel at the site are grossly inadequate in ensuring proper management of the landfills. The shortage of personnel and facilities is connected with shortage of funds from the State Government. Furthermore, management of the sites does not yet conform to international standards for landfill management. This has increased the negative impacts arising from the location and management of the landfills.

In a bid to obliterate the hazards inherent in the indiscriminate management of medical wastes in the state, a medical wastes treatment facility has been established within the integrated landfill site at Epe. This became necessary due to the health and environmental problems that the current means of disposing medical wastes constitute (The Punch, 2006).

Conclusions

This review has shown that landfills within Lagos metropolis are uncontrolled and do not conform to international standards of operations. This non-compliance results into proliferation of insects and rodents, blowing of litter and causes odour and general environmental degradation. This is consistent with earlier findings by Arimah and Adinnu (1995). This revelation has practical implications for the siting of landfills in Nigerian urban areas.

It is tempting to suggest that in order to minimize negative externalities, landfills should be located as far away as possible from human settlements. However, this may not suffice, given the scarcity of urban land, especially in Lagos. Overtime, new settlements may spring up around the landfills. These negative impacts can be minimized through pragmatic design and proper management of landfills within urban areas. Such design and management should enhance the sanitary and aesthetic conditions of the landfills; it can minimize the generation of green house gases such as methane; and it can also reduce production of leachates that would contaminate underground water sources. All these will go

a long way in ensuring that landfills in Nigerian urban areas are environmentally acceptable.

In Nigeria, some of the issues that could be addressed as far as waste management practices are concerned include following:

1. There is the need for municipal governments in Nigeria to recognize solid waste management as a major problem and allocate adequate financial and other resources to efficiently and effectively solve the problem. If the available internal municipal resources are inadequate, such municipal authorities can study the cost and benefits of contracting of waste collection and disposal operations to private operators.
2. It is important to produce Environmental Impact Statements (EIS) for all new large-scale landfill sites in the country. In the EIS, consideration should be given not only to the material aspects of development and environment, but also to those groups in society that are likely to be affected by the development proposals.
3. Existing and all future landfill sites should be designed and operated under appropriate physical planning and engineering standards. Such standards relate to solid waste transportation, accessibility, tipping, quantity and depth of sand (15 cm) to be spread within 24 h of tipping, and provision of fencing around the sites.

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