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EVOLVING AN EFFECTIVE DUMPSITE MANAGEMENT STRATEGY FOR A BETTER WASTE MANAGEMENT IN RIVERS STATE

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ABSTRACT

This paper discusses conditions of Rivers State dumpsites, the activities involved, methods used as well as Best Available Technologies (BAT) for solid waste dumpsites in Britain that may be applied in the state. It then compares the two systems of solid waste disposal and observed that there is urgent need to change from dumpsites as solid waste disposal structures to sanitary landfill, as is the case with the civilized world. The waste dump system practiced in the Rivers State has been identified as one of the culprits in the increase of water bone diseases in the state; diarrheas, dysentery, typhoid fever, cholera, "sweetie", etc have been linked to surface and ground water pollutions from solid waste dump Leach ate in the Port Harcourt Metropolis. It was also observed that solid waste and dumpsites are responsible for the perceived change of the nature of Port Harcourt from Garden City to Garbage City. This garbage nature can be reversed to the original garden city if and when the Rivers State adopts the embraces the use of sanitary Landfill for ultimate solid waste disposal, historical facts from those who have used the system for over a century. It is therefore recommended that modern landfill site management approach be adopted in all solid waste dumpsite in the Rivers State as a mean of evolving effective dumpsite management for the state.

INTRODUCTION

Dumpsite management of solid waste involves processing and final disposal of waste. Processing is the second fundamental function of solid waste management. It is linked to solid waste collection through transfer. Solid wastes

are composed of yard wastes, wood wastes, food wastes, paper wastes, cardboard, plastics, textiles, rubber, leather, cuttings, chemicals, organics, glass, tincans, demolitions, nonferrous metals, ferrous metals, dirt, ashes, etc. (Sincero and Sincero, 1999).

These wastes are presently disposed off by dumping them into burrow piths, surface of the earth, streams and rivers, in Rivers State. Research works carried out in the Port Harcourt Metropolis have linked the increase in the incidence of diarrhoes, dysentery, typhoid fever, cholera, scabis, rashes, sweetee, etc. to the indiscriminate dumping in and around Port Harcourt and other major population centers of the state. (Babatunde et al, 1999).

According to Ayotamuno et al, (2003), there are also the toxic effects of unknown hazardous components of these wastes on the populace.
Over the years, epidemics caused by solid waste leachate related diseases have: drained the State and National health Care program, weakened the economy by reducing the available man-hour through diseases (Akor, 2003).

Processing the waste with the Best Available Technology (BAT) improves on the efficiency of handling and disposal of waste. The first and most important waste processing activity is the separation of the tangle into component parts. This followed by the disposal of the ultimate waste after removing the re-useable and recyclable components (Sincero and Sincero, 1999).
Solid waste dumpsites and collection points are the main factors responsible for the transition of Port Harcourt from Garden to Garbage City if Port Harcourt is to return to its original glory these dumps and collection points must be controlled through the application of Best Available Technology (BAT) in the management of the system. The BAT in the area of solid waste disposal is sanitary landfill (Byrnes, 1997). It is the structure that encases and degrades the degradable solid wastes such that the leachate and gases are controlled, reducing or eliminating the incidence of water-borne diseases as is the case in the countries using such system exist. Consequently, it is the objectives of this paper to: Identify the weaknesses in the dumpsite management systems in Rivers state; Proffer measures that may be taken to correct the weakness in the evolution of effective solid waste management system in Rivers State and to make recommendation on implementation strategies.

METHODOLOGY

The Rivers State solid waste management system was studied through the few literature available and field visits. The field visits covered the East-West road, Rumuagholu, Ikwerre Road, Abonnema wharf, Eastern-by-Pass, Borokiri Area, Omoku – Ahoada Road, Eleme – Bori Road, Ahoada – Buguma/Abonnema. These areas were selected because all the dumpsites in the state are locate there in. in all, 109 dumpsites were visited. Out of these, six (6) dumpsites were visited during the dumping operation.
Information was also obtained through verbal interviews and discussion with truck drivers, operators and dumpsite neighbours. In three occasions, truck drivers and their operatives were followed from collection points to dumpsites.

As the bases for comparism, the solid waste treatment and disposal system of Great Britain were studied through literature and the internet. The data obtained were analyzed by comparing the dumpsite system in the Rivers State to the solid waste disposal system in Britain. The differences in the two systems with respect to the incidence of epidemics, longevity, sanitation and regulation were observed.

OBSERVATIONS AND DISCUSSIONS

Solid Waste Components

Generally, the typical make-up of municipal solid waste is shown in table 1.
Table 1 shows the composition, moisture content and density of typical solid wastes components. Paper, food waste, glass and plastic are the main constituents, followed by tin cans, wood and ferrous materials. Moisture content is highest in yard wastes and food wastes, followed by organics and wood wastes. The others are dry enough to be incinerated. Dirts, ashes, etc are the heaviest components, followed by ferrous metals, food wastes, wood wastes, gasses, non-ferrous metals, organics, leather, yard wastes and others.

Table 1: Composition moisture content and density of solid waste components

Composition	**Composition(%)**		**Moisture content(%)**		**Density (Kg/m^3)**	
	Range	*Typical*	*Range*	*Typical*	*Range*	*Typical*
Yard wastes	0-10	10	45-85	60	60-200	100
Wood wastes	1-3	2	15-40	25	130-340	230
Food Wastes	5-25	17	45-85	60	130-500	300

Paper	10-40	33	3-8	5	40-140	90
Cardboard	3-10	8	3-8	5	40-80	50
Plastics	2-8	5	1-3	2	40-130	60
Textiles	0-3	2	5-15	10	40-100	60
Rubber	0-1	0.5	2-4	2	80-200	130
Leather	0-2	0.5	8-10	9	100-260	150
Organics	0-4	2	10-60	25	100-350	150
Glass	4-15	5	0.5-1	0.5	150-500	200
Tin can	1-7	5	0.5-1	0.5	50-160	90
Non ferrous	0-1	1	0.5-1	0.5	50-240	160
Ferrous metal	1-3	1	0.5-1	0.5	150-1200	350
Dirt, ashes, etc	0-10	8	6-12	8	320-960	480

Adapted from Sincero and Sincero (1999)

Conditions of the Rivers State Dumpsite

In the dumpsite system practiced by the Rivers State, the wastes are not separated into the different components or recyclable groups. Human scavengers are seen daily at the open dumpsites teasing out and selecting reuseable and recycleable components. Plate 1 and 2 show a burrow pit dumpsite at Rumuagholu and a surface dumpsite at Rumuigbo – Nkpolu Junction by East-West Road, Port Harcourt. Notice the burnt areas of the two plates and the smoking spot in plate 2. These dumps spew millions of kilograms odorous toxic emissions and green house gases into the atmosphere monthly.

Plate 1: Burrrow pit Dumpsite at Rumuagholu

Plate 2: Surface Dumpsite at Rumuigbo - Nkpolu

Rivers State dumpsites are mainly left-over burrow pits from road construction earth work and road side surfaces (plate 1 and 2). Solid wastes are dumped indiscriminately without separation into any selected burrow pit or road side surfaces. The wastes are then scattered all over the dump area (with little or no compaction) and left open to vectors (files, vermins etc). and the element, until the next truck load is dumped and scattered the next time. Dumping and scattering of solid waste are randomly executed and the choice of dumpsite is based on distance and accessibility only. Soil type, water table, drainage condition and air pollution are not considered. Most of these dumps turn to solid waste pond during the rainy season polluting surface and ground water. Fire is started from time to time in the heaps of solid waste when the heat generated by the activity energy of microbes reaches the auto-ignition temperature of surrounding combustible solids, in the presence of the highly combustible anaerobic gases – mainly methane. The combustion of the solid waste dumps deprive the public of potential usable rapid combustion energy and produce green house gases (CO, CO_2, SO_x, and NO_x).

The dumpsite technology as described above is mediaval in content except in the use of dump truck instead of baskets, hampers, basins and manual trucks for waste for waste transfer. There is no element of work study or science applied

to the dumpsite management in Rivers State. Out of the 109 dumpsites visited, 17 are simply heaps of waste scattered on the ground (no burrow pit). It was difficult to determine whether 6 of them are collection points or dumpsites, because the wastes were scattered on the surface, and the locations were less than 10m from dwellings.

Solid Waste Treatment and Disposal in the United Kingdom

The major solid waste treatment and disposal system in the United Kingdom is the; sanitary landfill burial, incineration, reuse and recycling. Reuseable and recyclable waste components become useful again and at the end of its use may generate less quantity of waste in a latter date. Even this ultimate waste (e.g. ashes) is finally disposed off in sanitary landfills or use in construction and road buildings (Byrne, 1997). Table 2 shows the number and the different types of waste – disposal facility in the United Kingdom.

Table 2: Number of and different types of waste management facilities in the United Kingdom

S/N	Disposal method	Number of disposal licenses
1.	Landfill	4196
2.	Incineration	212
3.	Treatment (Physical, Chemical Biological)	122
4.	Other (including recycling)	366

Adapted from Byrne (1997)

Table 2 shows that 86 percent of solid waste in the United Kingdom is disposed through the sanitary landfill system. In the real sense of it, the percentage is higher because the incineration ashes and some of the others may still find their way into the landfill after reuse or recycling. At present, the only method of disposal currently allowed and permitted is the use of sanitary landfill (Sincero and Sincero, 1999). The sanitary landfill method is an engineered burial of solid wastes consisting essentially of spreading waste on dug-out area or trench or on the ground, compacting it, and covering it with soil at the end of the working day or other suitable intervals.

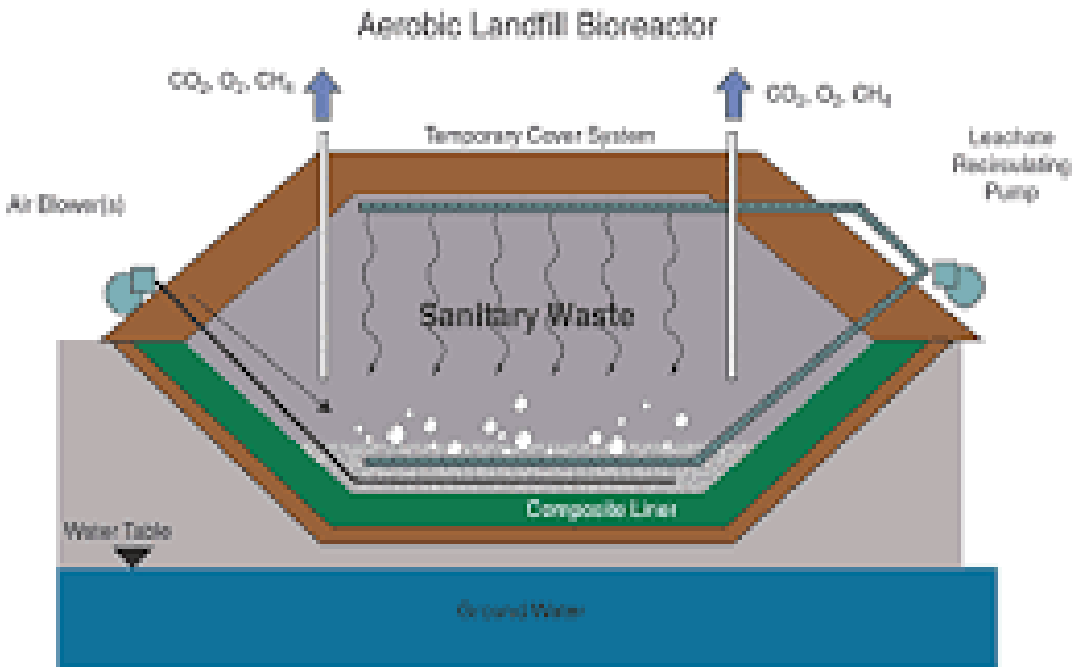

Fig 1: Sanitary Landfill Area Type

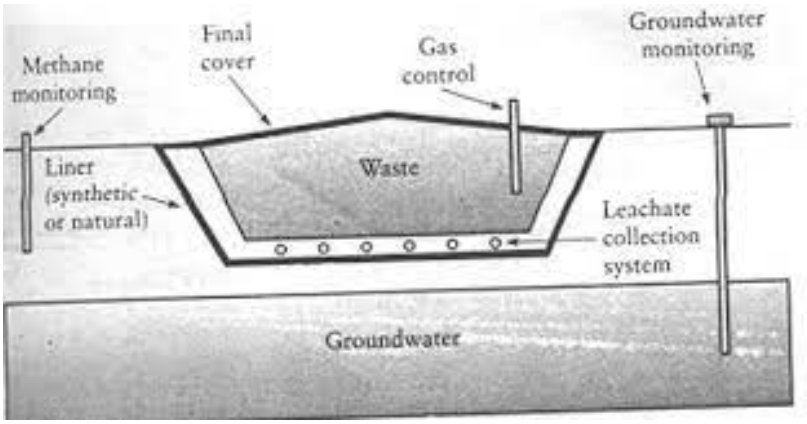

Fig 2: Sanitary Landfill Trench Type

Figure 1 and 2 show the two categories of sanitary landfills – area and trench types. The difference is that: the area method is used when it is impossible to excavate, especially when water table is high, so that a berm is constructed and the solid wastes are simply dumped on the ground, spread in layers of about 0.5m and compacted. Another layer of 0.5m is them placed on top of the previous layer and also compacted, layering and compaction are repeated until a height of 2 to 3m is reached.

At this point and at the end of the working day a cover blanket (the daily cover) of 150 to 300mm or earth is compacted on the top of the height. When the limit

of number of lifts is reached (determined by the side slope of the resulting heap not exceeding a maximum of 1 vertical to 4 horizontal) a cap system is them installed on top of the final cover (about 0.5 – 1.0m).

Fig 3: Hazardous Waste Landfill

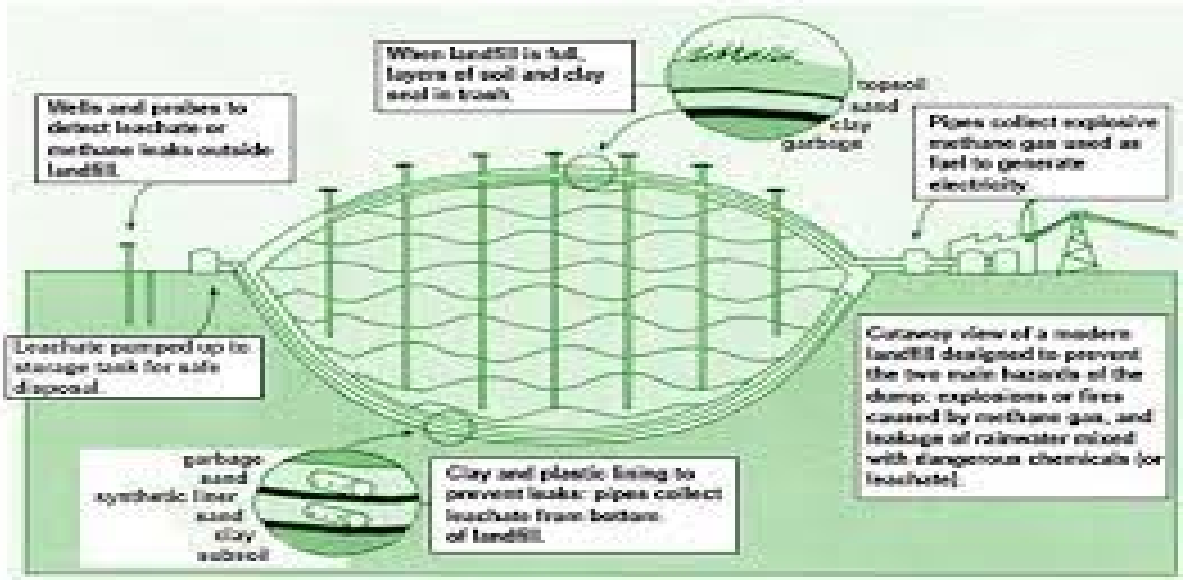

Fig 4: Municipal Solid waste Landfill

The cover (blanket) material for area landfills are imported off site (fig 1). On the other hand, the trench type is excavated and cover materials are obtained from the spoil (insitu, fig. 2). The width of the trench must allow free and easy movement of vehicles and equipment. Other operations such as filling, compacting and covering are exactly the same as in the area method. In the design and implementation of landfill programme, serious consideration must be given to: site selection, leachate control, gas control, operation plan, and permit application. Leachate and gas is controlled through perforated drain pipes or channels (fig 2). Figure 3 is typical hazardous waste landfill, while figure 4 is municipal solid waste landfill.

The hazardous wastes landfill is more expensive than the municipal solid waste landfill because of special feature such as the drainage requirement, filter medium, flexible membrane liner, layers of soil and compacted clay.

The sanitary landfill encases the waste some of which degrade with time according to the carbon – Nitrogen ratio (C-NR). The products of the anaerobic reactions, the gas, manure and leachate may be harnessed to produce electricity, fertilizer (compost), and piped to final disposal by irrigation or further treatment before disposal.

Comparism:

The dumpsite of the Rivers State are unconsolidated (uncompacted) burrow pits or road sides ground surface areas which allow the pollution of both surface and ground water by the leachate of lead, nitrates, metals, microbiological contaminants etc. The dumps are open, polluting the air environment with methane, (CH_4) hydrogen sulfide ($H2_S$) etc. In addition to this spontaneous combustion of the dumped wastes releases CO, CO2, NOx. These are green house gases – precursors for global warming, and troposheric ozone formation.

Table 3: Health Risks Associated with Surface and Ground Water Contaminated by Waste Dump Leachates

S/N	Substances	Major Source	Associated Risk
1.	Lead (Pb)	Piping and solder in distribution system released as very five mist of in organic lead.	Learning disability in children, nerve problems, birth defects
2.	Nitrogen oxides (NO_x-N_2O,NO, NO_2 NO_3)	Fertilizer, treated sewage, feed lot combustion of tossi fuel/waste	Methemoglobinemic (Blue baby syndrome)
3.	Metals	Waste disposal practices	Liver, kidney, circulatory problem
4.	Microbiological contamination	Septic solid waste leachate	Acute gastrointestinal illness – dysentery, cholera, typhoid etc and meningitis.
5.	Tropospheric ozone (O_3)	Found as secondary pollutants when No_x reacts with volatile hydrocarbon in the presence of sunlight	Respiratory, eye nose and throat irritation
6.	Carbon monoxide (CO)	Incomplete combustion of water	Carboxyhaemoglobin which decreases the oxygen content of blood impair visual acuity and concentration
7.	Organic waste	Sewage, biodegradable solid waste	Water born diseases, cholera, typhoid etc.

On the other hand, sanitary landfill isolates all the waste component, treat (process) and recycle them or dispose off the less toxic effluent on land or body of water. A good management plan for a sanitary landfill include provision of:

- Access road to the site and to all action points on the site, use high strength pipe in the landfill to withstand the heavy traffic of compactors dump trucks.
- Monitoring structures (wells man holes)
- Filling sequence (subdivide landfill into cells)
- Source of cover materials (institute of imported)
- Drainage (around and within landfill)
- Equipment requirement (front-end-wheeled of track loader, bulldozer wheeled or track, earth mover, and landfill compactor)
- Closure plan (abandonment strategy, construction of cap system)
- Maintenance (post fill monitoring, injection of water required for decomposition, refilling of eroded areas, road work, fence work, slashing and weeding).

It has already been established that the bacteria, virus, fungi, worms, and toxic chemicals in the dumpsite leachate of Rivers State are responsible for the numerous water borne diseases incidence in the state. It has also been stated elsewhere in the paper that the diseases result in loss of man-hours and the declining economy. These are negatively contrasted from the healthy consequence of the Sanitary Landfill System in England. Epidemics of water borne disease has been effectively checked by the use of sanitary landfills in England (Byrne, 1997).

The landfill system controls the pathogens and chemical so that solid waste are safely disposed off, reused or recycled.

CONCLUSION AND RECOMMENDATION

An effective management strategy for the dumpsites in the Rivers State can evolve beginning with the adoption of the sanitary landfill system in the place of the open dump system present practiced. The open dumps do not control leachate, vermin, odor and constitutes the major sources of the water borne diseases which weakens the nation. The uncontrolled scattering of solid waste litters the unsightly wastes all over Port Harcourt metropolis, giving the name “garbage” rather then “garden” City to Port Harcourt. This situation can be reversed by the adoption of the landfill system. A properly operated sanitary landfill system can eliminate or reduce this unfortunate condition, and replace it with a healthy situation, in a healthy nation, using the recycled otherwise

poisons gas to produce more electricity for the state, and the organics for crop production.

In summary it is conclude that: Rivers State dumpsite system uses Mediaval waste dump technology. It is the reason why Port Harcourt is now the Garbage City instead of a Garden City. It is also the source of several water borne diseases in the communities. Diseases reduces available man – hour, weakens the economy and the Government Health – Care programs. There is need to change to sanitary landfill system which is yet at the cutting edge of technology.

Sanitary landfill business is a profitable venture when operated scientifically based on approved plan of work.

It is therefore recommended that: Government adopts the use of sanitary landfill in the place of the present dumpsites and provide license for operators. Design details are available base on site conditions.

The burrow pits within and near the Port Harcourt Metropolis and other population center of the state may be systematically and scientifically converted to area landfill system for the Rivers State.

Such sanitary landfill sites be made comfortable by providing snack-bar, bathroom/change room, (preferably in prefabricated structure or a mobile house) which must be sited scientifically allowing the prevailing wind to clean up the air environment all times.

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