

**SOLID WASTE MANAGEMENT IN PAIKO:
PROBLEMS AND PHYSICAL PLANNING
SOLUTIONS**

BY

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BEING


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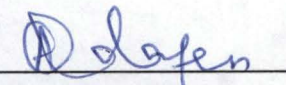
MARCH, 2002.

CERTIFICATION

I hereby certify that this work has been supervised, read and approved as meeting part of the requirement for the Award of P.G.D. Environmental Management of Federal University of Technology, Minna, Niger State.



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DECLARATION

I **MUSA S. BELLO** of the Department of Geography, School of Post Graduate, Federal University of Technology Minna, hereby declare that this research work “Solid Waste Management in Paiko: Problems and Physical Planning Solution” has been conducted by me from my research effort and to the best of my knowledge has not been earlier presented.

However, references from other works have been duly acknowledged and well credited herein accordingly.

DEDICATION

To my mum Hajiya Habiba Bello for her patience and encouragement. Also to Late Iliya Mohammed Bello and Musa Isah, may their gentle souls rest in perfect peace.

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Nigerians to give rise to waste unmanageable size. Other factors that have attributed to the magnitude of wastes include population size and rate of population growth within the urban centre; growing at an alarming rate as earlier stated, sanitation habit of the people and the general neglect of the population to environmental issues.

Solid waste accumulates in towns and cities due to bad layout, which makes houses inaccessible to waste disposal vehicle. Thus many solutions to solid waste problems developed in one country cannot be of value in others provided that they are applied with appropriate technology. Geography, economic, and social constraints must naturally be considered and few mechanized high technology systems developed in effluents countries can be usefully employed in developed areas.

The immediate environment as the closest associate of all being is the aggregate of most external conditional influences affecting the life and development of an organization both physical and biological forces of nature surrounding an individual. All mans basic needs and his very existence are found in this environment, although the environment is being influenced by intricate web of factors. The most prominent factor is been increase in human population.

In Nigeria, population is increasing in geometric rate about 3% with projected population of above 115 million in the year 2000.

TABLE 1.0 PROJECTED NATIONAL POPULATION 1991 – 2004

Year	Projected population	Gude densities per km ²
1990	85,993,483	92
1995	99,207,942	107
2000	115,224,312	124
2005	133,766,926	144
2015	178,575,651	192
2025	235,556,077	253
2030	263,813,190	289
2040	341,986,340	368

Source: NPC Nigeria at a Glance - Census '91

The population growth has led to increase of urban population, urbanization, combined with other factors like per capital consumption of resources and increasing level of technology, thereby causing severe pressure on eco-system (Kunle, etal 1996). Due to this pressure on ecosystem and the

attendant problems, United Nation Environmental Programme (UNEP) has been playing an important role in developing the knowledge of environmental problems and also how to solve problems such as solid waste management.

In our daily life, man generates waste matter in large quantities and in different form. These waste products were relatively disposed off adequately and its effect was less with less population then. But with the rise in human population, accelerated urbanization in Nigeria and political development in terms of creation of more states and local governments. There is corresponding pressure on urban centers and degradation of environmental quality and the larger the urban areas the lower the quality (Kunle et al, 1998).

1.02 THE STUDY AREA

Paiko became the headquarters of Paiko Local Government Area of Niger state as a result of Federal Government of Nigeria decision in 1998 to restructure and create more Local Governments in the nation. Paiko Local Government was later created and carved out of Chanchaga Local Government on 11th November 1991 by the Babangida's administration along with five other Local Governments in the State. Paiko is about 24km from the State Capital and located at the eastern part along new Minna to Suleja road. It shares boundaries with Chanchaga, Lapai and Gurara Local Governments. It is also blessed with a fertile land, which enables the habitants to produce agricultural products. These products are transported from neighboring towns to the main market whose activities hold every Friday.

A major road runs through the town dividing it into two political wards (Paiko North and South). The southern part where the modern market is located is densely populated because of the settlers that came from various towns and state for trading.

Paiko started as a small Gwari settlement but the population had risen with time because of the commercial activities that attracts people from other areas. The 1991 census conducted by the Federal Government shows that Paiko has a population of about 18,000. Today it has increased with in-grace of other ethnic group or emigrants which include the Hausas, Ibos, Yorubas, Nupes, Fulani's, Koros, Kadara's etc.

The economic activities of the people in this area includes business, weaving, trading of agricultural products such as Yam, Rice Maize, Beans, Cassava, Guinea corn, Millet and other farm products. These agricultural products are brought to one of the two major markets, the Abubakar Dada

modern market whose activities holds every Friday and located in the outskirts of the town. Unlike the modern market, the second market is located in the heart of the town and its activities holds every day to meet up the habitant daily needs.

One of the major sources of waste in the town is from this market activities. Other significant sources are carpentry works, operations involving intensive raising of livestock e.t.c and domestic sources which usually record the highest tonnes of waste.

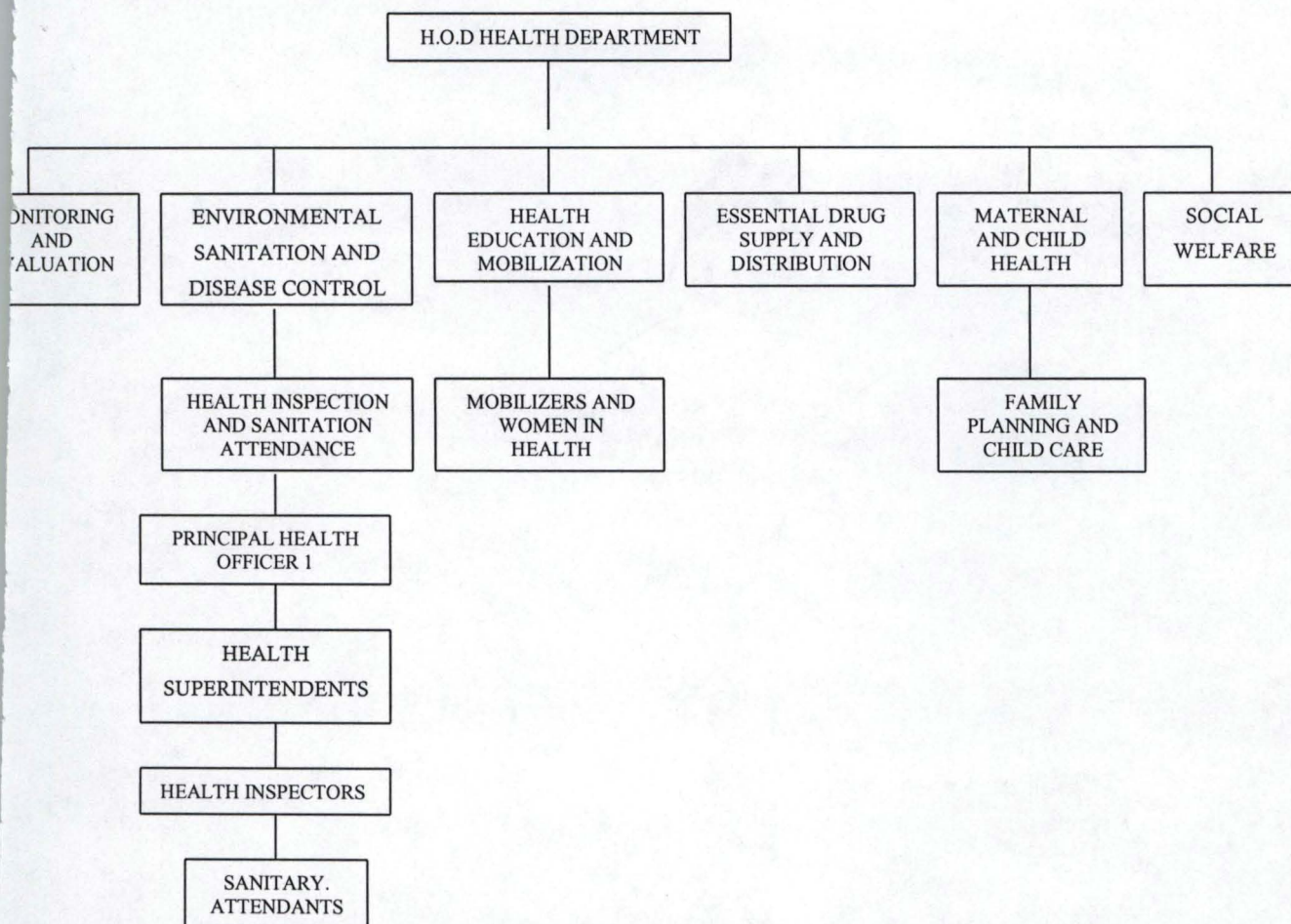
1.03 EXISTING SOLID WASTE MANAGEMENT SERVICES IN PAIKO

Paiko as the headquarters of Paiko Local Government has experienced continuous increase in volume of solid waste accumulating largely due to increasing population and coupled with uncontrolled and unplanned urbanization which has brought with it environmental degradation. Indeed, one of the most dreadful consequences of urbanization in developing countries like Nigeria has been the problem of waste management. The magnitude of waste management in Paiko is enormous. This problem has become a monster, which has rendered abortive most efforts being made by the Local Government Authority.

Following the efforts made by the past administrators of Niger state like Col. A.B Mark in launching of War Against Indiscipline and giving priority to solid waste management in both State and Local Government for sanitation purpose were provided and as well as logistics in order to manage solid waste in the State which was good and sufficient. But the problem of waste began when the regime elapsed as result of non-funding of the appropriate organization. The monthly subvention for this purpose was drastically cut down thereby leading to indiscriminate dumping of solid waste in every nook and crannies of the town. The accumulated solid wastes dumped on the dumping side were left uncollected. The local body responsible for the management could not carry out the much demanded assignment given to it as the facilities available to collect the refuse could not cope with the increase in waste generation mainly due to astronomical increase of the town. All the dumping site in the town were unsanitary with no ground cover, fencing, drainage or guard therefore some of the refuse were dumped along the street. Also there was the problem of coordination. The Local Government Health Department staff were not co-ordinating well with the public. In view of the above situation, there is need to study the character of solid waste generation, assess the disposal and management patterns and problems associated with it in order to explore other potential ways of managing solid waste in the face of increasing population pressure. On the basis of finding, it is hoped that a way of tackling solid waste management problem will be proposed.

CHART 1.0

**ADMINISTRATIVE CHART OF PAIKO LOCAL GOVERNMENT
HEALTH DEPARTMENT.**



Source: Survey 2002, Health Department Paiko Local Government Council.

1.04 STATEMENT OF RESEARCH

The sight of wide spread litters and heaps of un-cleared solid waste is very common in Paiko town. Volumes of waste are generated daily and are not efficiently managed by the body responsible for its management. This has given rise to the problem of waste accumulation along road sides, aesthetic problems and nuisance to the environment, health hazards (as heap of accumulated waste serve as an effective and fertile breeding ground for mosquitoes, flies, rodents, etc which are vectors of disease such as malaria, typhoid, cholera, diarrhea, e.t.c). The inability to adequately collect and manage this waste affects the sanitary standards of the town causing environmental problems. Such problems also include pollution of the atmosphere, contamination of ground waste and diminishing of aesthetic and economic value of the land.

With the environmental sanitation unit in both Local and State Government of the country, there has been some improvement. However, the Authority still finds it difficult to completely rid the streets of refuse, perhaps, because of operational difficulties such as inadequate personnel, equipment, proper research and data collection and even improper location of refuse bins in relation to the source of wastes.

To a large extent the method of waste management in Paiko is based on an ad-hoc approach. In view of this, there is the need to review the existing practice of solid waste management in Paiko particularly.

1.05 AIMS AND OBJECTIVES OF THE STUDY

The aim of this research is to examine and analyze the problem of solid waste management in Paiko with a view to making proposals for an effective management system.

To achieve this ultimate goal, the following objectives as policy tools must be comprehensive enough to cater for the multipurpose requirements of a healthy environment.

1. To review the concept of solid waste and its management
2. To identify and analyze the types, sources and characteristics of solid waste in Paiko
3. To study the management practices and policies that Paiko local government has towards waste management in the town.
4. To examine the problems militating against the effective management of solid waste in Paiko.
5. To make a planning proposal for effective solid waste management in Paiko.

1.06 SCOPE AND LIMITATION.

The study focuses on waste management in Paiko town, problems and physical planning solutions. The method used to classify waste in this study was based on land use. It was not possible to reach out to every house and everybody, hence questionnaires were used.

Secondly, some respondents were skeptical of the whole exercise for fear of being reprimanded, but this was taken care of through explanation on the purpose of the study.

Lastly, some questionnaires were not returned as part of carelessness of the respondents.

1.07 SIGNIFICANCE OF THE STUDY

Due to rapid urbanization, waste management has become a major problem. Man's activities result in the generation of solid waste and its associated problems.

In curbing the menace of refuse, environmental management came to be accepted as a nationwide programme, public enlightenment through advert was used by the various public agencies to check proliferous nature of refuse materials in our society.

The study is aimed at contributing to the already existing body of knowledge about good sanitary environment and aesthetic. The study will also endeavor to find the various sources and characteristics of solid waste, method of management and problems associated with its management. The study becomes more significant considering the problems of ineffective solid waste management, hence the need to profile or suggest solutions to the identified problems.

The study will at long run serve as a reference material to individuals, NGOs and public institutions.

1.08 DELIMITATION OF THE STUDY

- i. Variable of source of waste, composition and disposal, attitude and habits on waste disposal system inadequacy of disposal facilities as they affect solid waste management.
- ii. Use of structured questionnaire, interview and reconnaissance survey of the town most especially the areas randomly selected.
- iii. Use of descriptive statistics of frequency and percentage to analyze and present data.

1.09 ORGANIZATION OF THE THESIS

The thesis is organized into five separate chapters; chapter one entails the general introduction of the research work, highlighting the background of solid waste management with both procedures and problems of this topic. It also covers the aims and objectives, scope and limitation of the thesis in order to achieve the required result in carrying out the research work.

Chapter two contains the review of literature from various writers and the general information covering solid waste, including problems and policies existing in the area of study and other relevant areas.

Chapter three focuses on the procedure and methods used in the research work. The details of all the data collected and the sample technique used can be found in this chapter while chapter four focuses on the analysis of the data obtained, presentation was also made. This includes results of findings, analysis and discussion of all the findings in a detailed form.

Finally, chapter five gives the summary of the whole research work, including the proposals that were made by the researcher, the conclusion and recommendations according to the findings were made likewise the bibliographic reference covering the research work.

CHAPTER TWO

2.0 LITERATURE REVIEW

INTRODUCTION

Solid waste according to Olawande (1991) could be defined as “the collective name for all component parts of solid wastes which includes domestic, industrial and agricultural operations which may be found in human environment”. Berry et al (1974) calls it any unwanted thing that are injurious to human health or undesirable materials that originate from industrial, mining project, agricultural as well as from residential, commercial and municipal uses of the urban areas. The expert committee of World Health Organization (1971) sees solid waste as “useless unwanted or discarded materials that arise from man’s activities and are not free flowing”.

Of all the waste types, solid waste is the most problematic as it can be found in our cities and towns littering the streets, obstructing roads and drainage, polluting the environment and constituting a public health hazard. Between one-third and one-half of the towns trash goes uncollected.

2.01 TYPES OF SOLID WASTE.

The refuse generated in a town or city consists of a vast array of products which have lost their value and usefulness and has been discarded. These include domestic waste, commercial wastes, industrial wastes and agricultural wastes etc. These wastes result from sourcing, processing, marketing, storing and consumption of materials. In Nigeria, the quantity of residential waste and commercial waste exceeds other forms of waste (Tom. 1995).

i. Domestic Waste.

Domestic wastes includes paper, cardboard, metals, glass, food matter, ashes, plastic, wood and others discarded from homes, it also includes old furniture, household appliance, cellophane, rubber products, other gabages, dust and dirt. One important characteristic of this waste is that it is highly putrescible and tends to decompose. Some of these wastes are highly combustible such as papers, textiles, woods, plastics and cellophane. The non-combustible ones include glass, tin, cans, ferrous and non-ferrous metal. In some developing countries, ashes, dust and dirt may sometimes form the greater percentage of waste or refuse.

The increasing amounts of paper, cardboard, plastics, glass, and other types of packing are concomitants of improved standards of living. At the same time, the increasing use of gas, oil and electricity for heating and cooking has resulted in declining the ash content of solid wastes. Thus, the proportion of paper and paper products in domestic refuse has already reached more than 50% in some countries.

ii. Commercial Waste

These are mainly wastes produced by shops, markets, restaurant and office and consist largely of fibreboard containers, wooden crates, paper packaging, paper, carton papers, typewriter ribbons, punch cards, tape, etc. but may include food waste from cafeterias. Wastes from hotels, restaurants, hospitals and barracks are also included in this category. Most of these wastes are collected with domestic wastes.

Commercial waste is growing in importance not only as a result of increasing business activity, but also because there are few opportunities to deal with on-site.

iii. Industrial Waste

These include construction wastes (excavated materials from building sites and other building wastes) and all un-saleable factory wastes. The latter will comprise packaging materials, food wastes, off cuts and spoiled material of metal, plastic, wood or cardboard, textiles or other materials. Factory refuse will also include fuel residues resulting from the incineration of chemical wastes, which require treatment within the factory before being released for disposal. Refineries also produce solid waste, much of it bituminous. Some industrial wastes are highly toxic.

Other examples are trimmings and scrap from the food processing industries. Wastes produced in large quantities by mining and some other operations are usually treated by the respective industries themselves. The natural growth and diversity of industry generally, together with rapid technological developments have resulted in substantial increase not only in the volume of industrial wastes, but also in their complexity. The quantity of industrial waste generated in Nigeria is lower than quantity of domestic or commercial waste (Tom, 1995).

iv. Institutional Waste

These include wastes that are generated from clinics, hospitals, banks and schools etc. These are sometimes similar to domestic waste but contain slightly larger appliances, cases, woods, plastics, leather goods, papers etc.

v. Agricultural and Animal Waste

These are made up of crop residues, poultry and other animal manures (particularly from intensive breeding and fattening), waste arising from the production and processing of food other crops, certain waste arising from slaughter and from the preparation of carcasses and the waste arising from the intensive threshing of grain in central areas where great volumes of straw are produced and cannot be burned owing to pollution regulations.

Quite a number of urban and rural dwellers in Nigeria are directly involved in agricultural activities and are not engaged in the use of modern implements, therefore most of the waste generated through manual labour are brought into the city.

vi. Mining Wastes

The mining industry produces such a large amount of waste that special emphasis should be given to these materials. Large accumulations of processed or unprocessed minerals containing contaminants may be exposed to rain, which percolates through the mass and carries toxic or deleterious material to bodies of water and thus contaminates them.

vii. General Community Waste

General community waste includes demolition and construction debris, street refuse e.g. debris fallen from passing trucks, papers etc, discarded motor vehicles, and refuse arising from community services such as hospitals, abattoirs, transport systems, parks, canals and harbours. Special handling is required for potentially dangerous wastes such as those from hospitals, international sea ports and airports and firm using radioactive materials.

2.02. COMPOSITION AND QUALITY OF SOLID WASTE.

Because solid wastes are generated from many different sources, they naturally comprise an almost infinite variety of materials: these range in size from a speck of dust to a discarded automobile, and in density from foam plastics to lead.

The major constituents of domestic and commercial wastes are paper and fermentable organic matter. Dust, cinder, textiles, glass, crockery, wood, metals and plastics are often present, the relative proportions depending upon many local factors.

The proportions of the constituents of domestic wastes collected at a disposal site are virtually constant for a particular town and subject only to seasonal and long term changes, although this could be an upset by industrial deliveries. But differences in the characteristics of solid waste as between towns, and especially as between countries, can be enormous and the collection of local data is therefore essential for good design of collection and disposal systems. The wide variation in values for domestic solid waste between different countries is demonstrated in the following table:

Table 2.0 variation in values for domestic waste

	(Range of values excluding industrial wastes)
Per capital weight (kg/day)	0.2 - 3.0
Density (Kg/m ³)	100 - 500
Putrescible matter (%)	5 - 90
Paper (%)	0.25 - 55
Plastic (%)	0.1 - 7

Source: WHO expert committee on solid waste disposal and control, 1971

Where refuse production is low, density tends to be high (and vice-versa). It is emphasized that the above ranges relate only to domestic wastes. If industrial and agricultural wastes were to be taken into account, the variations might be several times greater.

2.03 SOLID WASTE GENERATION

This involves the identification of materials or objects as no longer being of any value and are either thrown away or put together in a place for subsequent disposal. Wastes are generated as a result of man's daily activities in his home or residents, municipal area, open spaces, commercial centres, industrial areas, institutions etc.

2.04 STORAGE

Storage of solid waste involves the use of different types of storage facilities like refuse bins, empty drums, receptacles and other containers for storing of waste after it has been generated. The following factors could be considered in the storage of solid wastes: the type of container to be used,

the location of the container, public health and aesthetics and the collection methods to be used. However, the types and capacities of the containers used depend on the characteristics of the solid waste to be collected, the frequency and the space available for the placement of containers.

2.05 COLLECTION

Collection of solid waste is one of the crucial stage of solid waste management system. It is labour intensive and involves the removal or moving away of waste from generation point or storage point to disposal unit. The quantity, characteristics and source of vehicle and collection system to be used. Waste collection varies from one land use area to another and it is the responsibility of the local government council, but sometimes private contactors are hired to assist in the collection system.

The most common technique used for waste collection in Nigeria includes street corner collection (also known as Chinese collection system) in which waste discharged directly into collection vehicle from households. This method is very efficient in terms of cost reduction, maintenance of aesthetics and prevention of hazards. Another technique used is communal collection system in which waste generated are collected from disposal points within the city or town. Wastes are collected from skip bins, storage containers, constructed enclosures etc. Road side collection is also another technique in which wastes are collected from street to street from containers provided for waste collection in front of houses and other structures, this system is practiced extensively in place like the capital city of Nigeria, Abuja.

The collection and transportation of solid waste is the most costly phase and may account for up to 80% of total costs. Some cities have been able to achieve good standards at reasonable cost by means of efficient and highly mechanized systems of collecting, compacting, containerizing and unloading of the waste; some have also benefited from systems analysis techniques and from incentive bonus schemes to increase output per man-hour. There still exist great scope for application of these methods to other cities subject always to the limitations imposed by special local conditions. For example, the existence of very narrow streets in some towns may necessitate the use of hand-barrows, cycles or motor-scooters instead of trucks. The nature of the wastes may also be such as to limit the usefulness of compaction equipment.

2.06 **TRANSFER AND TRANSPORT:** The conventional method of transporting refuse to disposal sites is through vehicles of different categories which include: open truck tippers, the close top non-compacting truck, the close top compacting truck and the pulverizing truck.

The principle of transfer and transport involves the transfer of wastes from a smaller collection vehicle to the larger transport equipment or tractor-trailer trucks usually at the transfer station and then the subsequent transport of the waste usually over a long distance to the disposal sites located some kilometers away from the town/city. The waste could also be transported directly to the disposal sites from the collection points in cases where there are no sufficient equipment to be used for transfer.

2.07 PROCESSING AND RECOVERY

Solid waste or selected components of solid waste depending on the local condition may be of value as a source of raw material for industries, fuel for the production of power, material for land reclamation and agricultural purposes. The processing of solid waste is carried out through incinerator drying and dewatering (i.e moisture content reduction), component separation which can be done manually or mechanically. The manual method of separation has the following advantages and disadvantages.

Advantages:

1. It is less expensive and readily available
2. More employment opportunities for people
3. Does not require skilled labour

Disadvantages:

1. It is time consuming and can be done only in small scale
2. Lack skills
3. No organization in operation
4. It is not sufficient

The mechanical method of separation has the following advantages

1. It is very efficient and faster in operation
2. It could be operated on both large and small scale

Disadvantages

1. Capital intensive
2. May not be readily available
3. There could be failure of machines
4. Requires skilled labour

2.08 SOLID WASTE DISPOSAL AND CONTROL

The disposal of waste must take place within a closed environment comprising only earth, air, and water. When the liquid, solid or gaseous residues from waste treatment are disposed off, they must be discharged into one or more of these phases of the environment. Any or all of the phases may be polluted, and any solution to the general problem of the disposal of wastes therefore involve a decision as to which part of the environment can accept residues with least damage to the whole. In other words, in deciding on a site for the disposal of residues, their total effect on the environment must be studied. Wastes must no longer be transferred from one environmental phase to another without adequate study. This is particularly important in view of the fact that some residues persist permanently.

It has been necessary to recognize at every stage in the handling and disposal of solid wastes the possibility of interaction with the total environment. For example, health has been considered not merely as a matter of direct or indirect day-to-day risks, but also in the context of man's dependence for food on a complex chain of energy conversion.

Solid waste disposal is the removal of refuse from where it was generated to a place of disposal. Disposition of solid waste can be said to have been made when it is collected, transported, treated, and disposed off to a place where it may not constitute environmental menace/problems. The necessity for proper solid waste collection and disposal stem from the concern that improperly stored or treated waste can feed disease bearing pests such as (rats, flies, mosquitoes etc) and endanger public health.

Refuse collection is the purpose of refuse removal and disposal of solid waste especially garbage to minimize the possibility of disease and to reduce the effects of littering the environment and pollution. But the attitude of the inhabitants in keeping good environment may contribute to the piling of refuse. Hence, Molly O' mearn (1999) observes that remains from some of the earliest cities suggest that residents at first look "devil may care" approach to solid waste disposal, simply raising the roof of their houses as mounting garbage lifted street levels.

Similarly, Anderson (1973) stated that the sheer volume in a year can develop to a mountain stock pile. He added that if each year's waste accumulated in a period of two (2) years a community would be buried by its own waste product. Finally, Nsan, (1984) said that if the present poor

attitude of environment remains unchanged. Nigeria would need about ₦1.36 billion annually to clear the mountain of refuse which would have built up in the country.

The above views shows the importance of adequate refuse collection and disposal. Though most of our towns are far from being free of solid waste. Inselberge and Jehu ,(1999) concerted effort is being made by all concern. To this end different method of disposal is being employed.

Most settlements have been sited to take advantage of water for human activities. These series and streams that provide drinking water are used to carry away wastes most especially household and industrial wastes so as the flow of water into a city and the flow of wastes out are intimately linked (Molly O' meara 1999). This method though still in use, has it adverse effects on pollution of water and killing of aquatic lives.

Another traditional method of household waste disposal is by feeding animal with waste, where they are composed of food items and after separating from those that cannot be consumed. E.g yam peels are fed to goats and left over cooked foods to pigs.

The house to house collection method is already in use, in many cities and towns like Abuja, Ibadan, Lagos and Enugu. This has been introduced in Minna by Niger State Urban Development Board and also has accredited some private solid waste collectors like Zuma, Rola Holdings etc to collect and dispose off refuse from some household, commercial and business centres in Minna.

Burning of waste or refuse is another method of solid waste disposal in most urban cities/centers, fire is often set on mountain of refuse to reduce the size of it. It is said that burning reduces the amount of waste to between 10-15%. But open burning of dumping site causes air pollution which may result into respiratory disease.

2.09 SOLID WASTE TREATMENT

While considering the adoption of suitable treatment facilities, particularly in the developing countries, due regard must be given to the characteristics of the waste, the climate, and the desirability of introducing minimal mechanization in the initial phase. The health of the public in general and of refuse workers in particular also needs consideration. Long term changes in the character of the wastes and the development of new packaging and other materials will also, in due course; inevitably require modifications in existing treatment methods.

The processing of solid waste prior to disposal on land should be in part determined by the planned future use of the land once deposit is complete. It may also be necessary to extend the land fill life of the site, in which case a treatment offering maximum volume reduction would be required.

Solid waste should be viewed as a resource when considered against the background that salvaging of various components in the waste can help offset cost of collection, treatment and disposal operations.

Some industrial wastes are very harmful, so collection should be done with hand gloves nose mask and all other safety precautions. The heaping of the waste should be taken into consideration for the possibility of harmful exposure and potential of atmospheric pollution. For solid harmless waste, the storage should be in short concrete walls. Organic waste should be in thick containers with little or no exposures to the atmosphere.

For toxic waste, extra cautions should be taken during collection and storage. Storage should be in air tight containers and vacuum sealed. Transportation of the waste to the treatment and disposal centres should be done promptly. This is always carried out in appropriate vehicles such as recovery vehicles/vans, tipper dinosaur, bulk container vehicles etc. These are often complemented with a mobile workshop to provide maintenance services.

i. Composting

Composting could be regarded more as a recycling than a treatment method because its purpose is to convert the fermentable organic content of wastes into a soil conditioner and no specific land allocation is required for final disposal of this product but only for the rejected materials, usually a minor proportion of the total. Composting methods ranges from manually operated pits to highly mechanized plans that also include separation of useful materials so as to recycle as much of the waste materials as possible. Problems of marketing compost restrict the use of this method, particularly in Europe and in the U.S.A although it is practiced on a wide scale in some of the developing countries.

The biodegradable class of solid waste is normally subjected to composting. This is a process of indigestion of tissues and organic substances to release the bound materials thus making them available to plants for growth.

The organic fertilizer obtained from this process is useful for agricultural purposes as well as for fighting desertification and soil erosion. It is rich in nutrients and unlike chemical fertilizers. It does not pollute the environment.

ii. Pulverizing

Pulverization (usually by hammer-mill) is a quick and relatively simple treatment that produces a dense, homogenous and relatively in-offensive material capable of reducing subsequent transport costs and land requirements for sanitary landfill. Land reclaimed with pulverized refuse has a much more predictable soil structure than land on which crude refuse is used.

iii. Incineration

This is process of burning dried solid waste through the use of flame or a steam or hot gases. This is carried out in modern incinerators which are plant like in structure with provision for the removal of the by-products like ash, salvageable metal etc. This method is employed where there is sufficient land where the choosen area, is not affected by the local weather conditions.

Through incineration, a large volume of sludge or refuse, can be reduced to a small quantity of ash which is free of organic matter and therefore used as an ingredient in the manufacture of burnt bricks, roofing sheets, cement, due, soap etc.

The ash equally as fertilizer serves for growing plants. The incombustible objects recovered from incineration are used for land filling or as components for the construction of embankments, they are reinforcement matters. However, a great disadvantage of incineration is that it leads to air pollution, but some are designed equipped and operated to meet air pollution control requirements. Incineration can reduce the volume of solid wastes by up to 90%.

In developed and developing countries, refuse disposal by incineration has been in use for some time. Modern incinerators are designed with special furnace where refuse is burnt. The incinerator has drying grates where the moisture content of the refuse is reduced to about 20%. The burning of the refuse takes place in the combustion chamber of furnace under controlled conditions. The temperature is often kept between 950⁰c and 1,100⁰c. To ensure complete burning of the waste, it is usual to supply 2 to 3 times as much air as required for total combustion.

Incineration is better than the open dump because the high temperature of the process kill disease vectors (flies and rats) and other pathogens. Incineration is compact and does not require much

space. The heat produced can be used for other useful purpose (e.g electricity generation). An Incinerator is better than sanitary land fill because it does not endanger ground water quality. The side effects of incineration are air pollution and its inability to handle certain types of waste such as explosives and potentially smoky wastes such as ashes, glass, metal and unburned combustibles. These are to be disposed off in sanitary land fill. Incineration is associated with fire hazard.

iv. Pyrolysis

Pyrolysis is the process by which organic wastes are decomposed under intense heat in the absence of oxygen. The products of pyrolysis are gaseous and liquid fuel such as char, alcohol, light oils and combustible gases. All these substances are potential fuels.

v. Deep-Well Injection

This method of waste disposal is particularly suitable for toxic fluid wastes from industries. Toxic wastes disposed by deep-well injection methods include acidic and caustic chemicals, oil field brine and radioactive wastes from uranium processing plants. Deep-well is dug into subsurface impermeable rock/layer which can act as an adequate reservoir of the wastes. A good understanding of the local subsurface geology of the area is important. Deep-well injection may be associated with the problem of ground water contamination.

vi. Barging

This method of waste disposal is used when there is not much space and the treatment site is adjacent to a deep body of flowing water usually an ocean. Here the raw precipitated or digested solid waste are dumped into waiting barge or ship when the Barger is fully loaded, it transports the waste to a suitable site far from shores where it was discharged usually by pumping it out deep under the surface of the water. This technique is employed when waste drying or treatment is cumbersome and expensive. The advantages of this method includes reduced land demand, and low operation of the receiving water course.

vii. Sanitary Land Fills

This is an easy method of disposing solid waste on land by spreading the waste in thin layers compacting them to the smallest practical volume and covering them with earth in a way that it protects the environment. Here there is no need to segregate the wastes into different components.

There are two basic landfill techniques. There is the trench technique which involves spreading and compacting of the waste in an excavated land. This is employed where the ground water table is low and the soil is more than four meters, and secondly the area technique which involves spreading of the waste on a natural surface of the ground, and subsequently compacting with layers of earth.

One big problem with landfill is that as result of the layering and compaction, an anaerobic atmosphere is generated inside the landfill and this gives rise to methane gas production. If this gas is not released, it can lead to an explosion of the site. Hence, during the preparation of the site horizontal network of pipes is laid to collect the methane gas to a vertical pipe at the end of which the gas is burnt of periodically. Landfill is a very hygienic way of solid waste disposal.

viii. Open Dump

Open dump is the earliest and the commonest mode of waste disposal. Solid wastes are dumped indiscriminately in any open space and even on streets and highways. In some cities in Nigeria such as Lagos, Ibadan, Aba and Onitsha, refuse accumulate in large heaps along some streets that it impedes pedestrian and vehicular movements. This method of waste disposal should be discouraged in view of the dangers associated with its practice. Open dumps are breeding grounds for houseflies and rodents which are vectors of a number of human diseases such as cholera and plague. They are also sources of offensive and noxious odours from rotting garbage.

2.10 THE EFFECT OF SOLID WASTE ON HEALTH AND WELFARE

Man generates waste as a result if his daily activities in a bid to maintain his means of livelihood to enhance and make his life comfortable. Waste generated by man has an adverse effect on the environment and subsequently on man himself.

i. Health Aspect:

Solid wastes vary throughout the world because both the quantity and the constituent are determined by social customs and living standards. As a society becomes industrialized, the traditional domestic solid waste are augmented by industrial, commercial and agricultural wastes, each of which adds a new potential for nuisance and sometimes a new threat to the health and welfare of human beings.

Most wastes are heterogeneous and may vary seasonally; thus there can be no uniform approach to the problem they present. However, two main categories exist universally. Fermentable organic

wastes, which will decompose rapidly, and non-fermentable wastes, which resist decomposition or decomposes very slowly.

Wastes in the first of these two groups arise primarily from the preparation of food consumption, and vary with the way of life and with living standards. In summer i.e. Europe the volume of these wastes increases because of abundant supply of fruits and vegetables and in winter it may decline, if some of the wastes are burned by fires. However, the importation of fresh foodstuffs out of season tends to modify the traditional composition of household wastes.

Ideally, solid wastes should not contain any faecal matter or urine, and the mixture of the latter wastes with household wastes should, as is the case with some developed countries, be prohibited by law. Differences, of enforcement, however, and variations in ways of life means that some tolerance has to be accepted in this matter. Where it occurs, such mixing makes it more difficult to undertake the collection of solid wastes in a manner satisfactory to the point of view environmental health. The handling of pathological wastes should also be prohibited. But pathogenic organisms will continue to be present in wastes in spite of all possible precautions.

Harm from waste products can arise from other causes inflammability because of paper content or by spontaneous combustion when in heaps; production of smoke; disgusting or nauseating smells and liquids during exposed fermentation in the open; the scattering of paper, plastic and dust by the wind; and the breeding of flies and rodents, the role of which is still of great importance in the spread of disease. It is necessary to concentrate attention on certain of these immediate problems: insects, rodents, polluted water and air, contact contamination, and accidents. There are also some long-term problems of man's food chain that has to be examined.

ii. Insects:

Various flies, particularly the housefly and the blowfly, breed near houses when there are waste products in the vicinity. They are also to be found at solid wastes disposal sites at which good standards of operation are not observed. Of course, it is relatively easy in temperate zones to avoid fly proliferation near human dwellings, but control is much more difficult in countries with low temperatures, high humidity and where the rate of decomposition of wastes is faster.

Flies have a very great power of dispersion, with a flight range over land of about 10 km in radius. Improper discharge of solid wastes in open drains or rivers may result in the creation of breeding places, a may the improper disposal of tins and automobile tires that hold waste.

iii. Rodents:

Rodents proliferate very rapidly in uncontrolled deposits of refuse, which serves as their main sources of food. Throughout the world there are periodic campaign to exanimate rats and mice, but the presence of food wastes permits rats to persist and to migrate from dumps to human dwellings in the vicinity. This creates a serious health problem because the rate may be a reservoir of plague, murinetyphus, leptospirosis, histoplasmosis, rat-bite fever, salmonellosis, tularaemia, trichinosis, and many other diseases.

iv. Solid wastes and air pollution:

Uncontrolled and incomplete combustion of solid waste materials can result in the release into the atmosphere of a number of undesirable pollutants, including particulate matter, sulphur dioxide, nitrogen oxide, various hydrocarbons and other noxious gases that may have deleterious effects on the health of those who inhale them. Large quantities of industrial solid wastes are deposited in landfill and some of these are toxic. Certain highly toxic wastes are dumped at sea. Leachate from industrial solid wastes may contain dissolved chemicals, particularly heavy metals which are poisonous. It has been demonstrated that such materials may be concentrated in nature by some organisms in man's food chain.

v. Epidemiological Studies:

A study in India of stool specimen from refuse workers indicated that 94% of this group were infected with selected parasites as against slightly more than 4% in the control group. The same study indicates that the infection rate with worms and related organisms was 3 times that in the control group. Contamination of this kind is liable to occur at all points where waste is handled. However, although it is certain that vector insects and rodents can transmit various pathogenic agents of diseases (amoebic and bacillary dysentery, typhoid fever and salmonellosis, various parasites, cholera, yellow fever, plague, leptospirosis etc.). It is often difficult to demonstrate the precise relationship between the sources of infection and the health of the population affected.

Another danger to refuse worker is the high accident rate attributable to heavy lifting and mechanized equipments. Although, no study has been completed specifically identifying the types of accident and permitting an accurate comparison of this rate with that in other occupations, it is believed that, at least in some countries - the rate is much higher among this group than among any other comparable working group.

Some evidence suggests that certain population group, may also be particularly influenced by improper solid wastes handling or disposal practices. In this connection, it would be desirable to investigate the influence on the mental and physical health of the aged, the infirm and the very young as well as on that of people living in the vicinity of treatment or disposal sites.

The importance of such cannot be overestimated because all the evidence suggests that a thorough cleaning of the environment is followed by a significant reduction in disease and a fall in the death rate.

The main source of air pollution from this cause is the deliberate, accidental, or spontaneous combustion of wastes deposits in the open, which gives rise to huge volumes of smoke and offensive odours. When rubber is present in the burning materials the problem becomes especially serious.

Another source of pollution is the old or inefficient incinerator plant. Combustion causes a large amount of dust to be suspended in fuel gases, and if dust eliminators are not installed it may be very unpleasant to live in the immediate environment of the plant. Some incineration plants have installed equipment to limit the generation or emission of dust, but only the newer plants are equipped with electrostatic precipitators.

The burning of plastics, particularly polyvinyl chloride, gives rise to hydrochloric acid, which not only causes corrosion in the plant but may also produce unacceptable aerial pollution in the vicinity. For this reason, consideration is being given to the possibility of replacing polyvinyl chloride by other synthetic products that do not have the same disadvantages. A warning is necessary with regards to the possible future marketing of even more dangerous plastics, for example, those based on fluorine.

Small (household or institutional) incinerators, which usually lacks dust extraction equipment, should be subjected to stringent controls, especially in urban communities, well designed incinerators are, however, a preferred method of destruction of pathological refuse for hospitals.

vi. Solid Wastes and Water Pollutions:

Rainwater that passes through a deposit of fermenting solid wastes emerges as a leachate, which contains a very high proportion of fermenting organic matter. While the possibility exists that pathogenic organisms may be carried some distance, studies have shown that in normal permeable

soils the bacterial penetration does not exceed a dozen meters. But where the deposit is sited on fissured rock, distant water sources may be contaminated. Hence, a geological and hydrological investigation by specialists is a necessary prerequisite to the use of a site for the deposit of solid wastes. When fermentable solid wastes are deposited in water-filled sites in impervious ground the damage is of a different nature and is due rather to the sulfite-reducing organisms, which may produce obnoxious odours over a considerable area.

vii. Socio-Economic Aspect

What some people may consider as wastes, may, for social or economic reason, be of value to others. The socio economic aspects of solid wastes management or mismanagement are bound to differ between the developing countries and the industrialized ones. But in both cases there are tangible socioeconomic effects, some which are dealt with below.

viii. Site Selection and Property Devaluation

Land is usually necessary for the final deposit of solid wastes and if these materials are dumped without prior treatment or planned operation, the land is spoiled for further use and the surrounding area is subjected to nuisance from insects, rodents, dust and smoke. Unfortunately this is the way in which most of the world's solid wastes are disposed of. To keep transport cost to a minimum, these sites are often very close to the urban areas that produce the wastes and they therefore cause economic blight: devaluation of land and property in the vicinity. Devaluation can also spread along the truck routes leading to the sites as a consequence of the steady stream of collection vehicles, sometimes with their contents exposed.

Bad practices of the past have often created a climate of public opinion that leads property owners to oppose location of any kind of treatment or disposal site in their vicinity and renders the acquisition of sites extremely difficult, even when high standard of operation are promised.

Every professional urban planners are often reluctant to allocate land for solid waste disposal. Far from being detrimental, however, a well-planned and well-operated solid waste disposal site may offer waste possibilities for land improvement e.g the reclamation of abandoned surface mineral workings, and the improvement of marsh or other unproductive land. Ever when sites of this kind are not conveniently situated in relation to the source of the solid waste they may be chosen for final deposition. If this likely to result in social and economic benefit in the form of public recreation land or industrial estates on reclaimed land

ix. Waste of Material Resources

There are other ways in which solid waste are not being made full use of as potential resource material. In the developing countries fermentable organic matter forms a high proportion of domestic wastes and can readily be transformed into compost, which in many countries would be a valuable soil conditioner and a minor source of plant nutrients. In the industrialized countries, the improper management of solid conditioner and a minor source of plant nutrients. In the industrialized countries the improper management of solid waste can lead loss of valuable mineral resources such as copper, lead, tin, zinc, aluminum, iron, and crude oil. When a nation's reserve of one or more of these mineral resources has declined to the extend that practically all its needs are imported from other parts of the world, it does not make economic sense for that nation to use these materials to produce items that are used briefly and then discarded and lost in a mass of heterogeneous materials buried under the surface of the ground.

x. Industrialization

The intense desire for industrialization often works to the detriment of environmental protection. The enforcement of good environmental practices, should it in any way endanger a promising industrial development is likely to be made subservient to the more apparent economic gains to be derived from the industry. Plentiful evidence of this, and of the disastrous effects that can result, exists in the worlds most industrialized nations. Since the costs of correcting the damage done may far exceed the economic benefits gained through the original decisions, good solid wastes management practice should be established at the beginnings of industrialization.

xi. Aesthetic Standards

The mental and social well-being of man cannot be achieved merely by attainment of material wealth. It requires also a physical environment in which he can live a comfortable and stress free life.

One of more obvious ways in which aesthetic standards are abused is the dropping of litter in towns and the countryside. Improper management of solid waste – in collection, transport, treatment and disposal may be regarded as a measure of a citizen's pride in his surroundings. Where lack of national pride and community pride are visibly demonstrated in disgraceful solid wastes management practices, it is not surprising that attitudes concerning litter will reflect this. In addition to the aesthetic problems of litter, there is a serious economic aspect. It is much more costly to retrieve items of litter from streets and parks than through well-organized storage and collection.

Another economic aspect that has been demonstrated in the USA is that, for many items found in litter, the cost of their recovery from the landscape greatly exceeds the original cost of production.

xii. Tourism

For some countries, tourism is a major source of foreign exchange and of vital importance to their economy. Tourism are sensitive to health and aesthetic standards and are quickly discouraged by deficiencies such as uncollected refuse stacked along the streets, odours and smoke from burning dump sites, litter in the countryside, floating debris, and scum on scenic water.

xiii. Special Problems of the Developing Countries

It is noted that in tropical and subtropical countries where temperature and humidity favour proliferation of insects and rapid decomposition of organic matter, frequent collection or exceptionally careful storage is required. Densely populated areas in which direct vehicular access is difficult or impossible necessitate the use of hand collection methods.

In some countries night soil has to be collected from house to house. Since the faecal matter is not completely digested and methods of collection and transport are not satisfactory, there are serious health hazards in handling such waste. Night soil is sometimes brought to a compost heap, where it is mixed with domestic refuse, adds to the fertilizing value of product. Close control is necessary to minimize health risks. If composting of refuse is not practiced, night soil should be digested separately before being used on land.

xiv. Special Problems of the Industrialized Countries

Although the following problems are more obvious at present in the industrialized countries, they are latent in the developing countries, which should seek to avoid some of the mistakes made by the industrialized countries, by planning for solid wastes disposal at an early stage of industrialization.

The greatest growth in the volume of domestic wastes is caused by the increasing prepackaging of food other goods. Although there can be no objection to the resulting improvement in hygiene, the necessity for some forms of packaging is questioned.

A difficult economic problem surrounds the recovery of raw materials such as metals, from solid wastes in areas where labour costs make this unprofitable. Should such activity be subsidized?

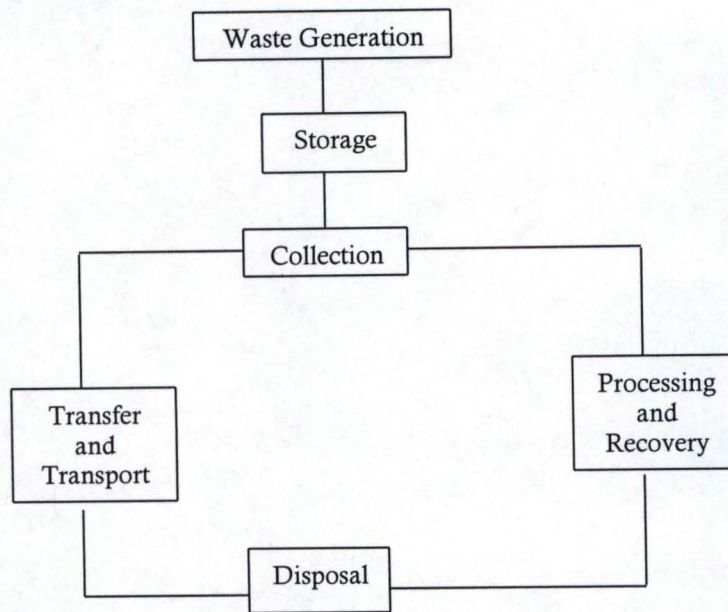
Many improvements in waste-water treatment increases sludge, which adds to the solid waste problem. Digested sludge from a sewage treatment plant must be disposed of either separately or mixed with refuse. Disposal of raw sludge should not be allowed because of the health hazards involved in such a practice. However, if both sewage and solid waste treatment facilities are located on one site and the solid waste treatment facility can handle raw sludge safely, the sludge may be added to refuse provided that it is mechanically transported to the refuse treatment unit. In some areas it may be economical to dry digested sludge and sell it for use in agriculture, but such markets are rare. In disposing of sludges, due attention should be paid to the possibility of its containing toxic substances- such as mercury- with a view to preventing their entering the water system or the food chain. Dredging of watercourses or estuaries often results in considerable amount of contaminated material, which must be disposed off on land in well-defined and contained locations

Solid waste from hospitals include pathological wastes, they should be collected separately from domestic wastes and burned in well-designed incinerator.

Agricultural waste may have special health implications and therefore needs careful disposal. The most difficult agricultural waste arise intensive rearing of poultry and other animals, packaging and canning of foodstuffs and slaughtering of livestock. The changing pattern of agriculture is resulting in a steady growth in the volume of agricultural wastes, particularly when burning of crop residues is prohibited to prevent air pollution. The obvious and satisfying solution is to return them to the land by working them into the soil by efficient composting or in association with sanitary landfill. The disposal of much industrial solid waste can be integrated with the disposal of domestic and commercial waste. Most mining wastes are harmless, but the leachate from certain industrial and mining disposal sites does contain toxic matter, which may have serious health implications. Such wastes should be strictly controlled because conventional water treatment methods do not normally remove dissolved toxic chemicals. Where industries are restrained from disposing of their wastes in to streams, lakes and public sewers, it is possible that sludges slurries, and sometime liquid waste, may be put in landfills. When this occurs additional care should be taken to prevent toxic chemicals from entering the water system.

During the past few years, large holiday camps have become popular in many countries. The amount of solid waste produced at these sites has risen to such levels as to require their inclusion in the refuse collection and disposal organization.

CHART 2.0 INTERRELATIONSHIPS OF THE FUNCTIONAL ELEMENTS IN A SOLID WASTE MANAGEMENT SYSTEM



Source: Solid Waste: Engineering Principle and Management issues.

2.11 SOLID WASTE MANAGEMENT

The health living of an individual depends solemnly on aesthetic and healthy nature of the environment he/she lives in, because of the influence it has on his/her physical, social and emotional health. A good sanitary environment ensures emotional well-being, beautiful scenery clean and orderly.

Society (Yabagi 1996), but man in his interaction with the environment most especially axes with population concentration, has not been able to keep an aesthetic and healthy environment. This was due to generation, concentration and inadequate management of waste that has been on increase.

According to Hillary, Rolf and George (1977), "solid waste management is the steps or stages which involves the generation, on-site storage, collection, transfer and transportation, processing and recovery and the disposal of solid waste and residue matter". Okpala (1986) also accerted that solid waste management is to collect, transport, treat and finally disposed off the waste in a hygiene and authentically acceptable manner at the lowest possible cost. Similarly, Ademulupiu and Kent (1988) saw waste management scope as the elimination, minimizing, reduction, identification, separation, segregation, collection, storage, transportation, disposal, treatment, sales and recycling of waste. It involves maintaining records of quantities, composition, destination and proof of disposal. Regular

monitoring and audit of waste management activities is also included. To this end, the management of solid waste is generally the process of controlling and eliminating the effects of solid waste. The management of waste involves the generation, storage, collection, transportation, processing and final disposal of the waste in an appropriate and approved manner and at a lowest possible cost. These stages form the fundamental and functional elements in solid waste management system. Those fundamental aspects and their relationship has to be identified and understood before solid waste management could be achieved in an efficient and orderly manner. A simplified diagram (table 2.2) shows the interrelationship of the functional element in a solid waste management system.

Accordingly, World Health Organization expert (WHO 1971) solid waste management has always been a function of local government (or a problem of an industry) until recent years rarely assisted or coordinated by higher levels of government. The fragmentation of management has often resulted in unplanned and inefficient operation, unnecessary risks to health, and damage to the environment.

Management, in the sense of systematic collection and analysis of all relevant data covering a sufficiently large area, has only recently been applied to solid wastes but is now recognized as a vital procedure for introduction of hygienic, efficient, and economic methods of operation. Solid wastes management is an important facet of environmental hygiene and needs to be integrated with total environmental planning. Its purpose is to provide a hygienic, efficient, and economic service organization to collect and transport solid wastes rapidly to treatment or disposal points, and to render the solid waste innocuous without transferring pollution load to the water system or the atmosphere.

For the management in our urban cities and rural areas, the concept of environmental sanitation came to being. Environmental sanitation is the control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on physical, mental and social well being (WHO).

For effective management of refuse and good sanitary environment, various successive governments have been formulating policies, spent money and time to achieve this.

2.12 PROBLEM AND POLICES OF SOLID WASTE MANAGEMENT

Solid wastes vary throughout the world because both the quantity and the constituents are determined by social customs and living standards. As society becomes industrialized the traditional

domestic solid wastes are augmented by industrial, commercial, and agricultural wastes, each of which adds a new potential for nuisance and sometimes a new threat to the health and welfare of human beings.

Certain management problem associated with waste management can contribute to the generation of waste in an area. An efficient waste disposal management will certainly bring about clean and solid waste free environment while reverse situation will pile up waste in an area. Such management problems could be finance, inadequate personnel, inadequate or lack of vehicle to handle the haulage of solid waste, lack of disposal sites, lack of adequate information on solid waste sites around the town etc. Other factors that can be attributed for solid waste generation in any urban and rural set up are socioeconomic background of the people, layout of the area in question e.t.c.

The composition of solid waste in any settlement reflects the nature and composition of its human activities, economic base and level of wealth. In general, the composition includes paper, glass, ceramics, metals, plastics, leather, rubber, wood, bones, straw, and textile vegetables e.t.c. The relative concentration varies with the economic sophistication of the community.

From available data concerning questions and characteristic of urban and rural solid wastes in Nigeria, waste are frequently carried to communal masonry bins or designated neighborhood dumping grounds for collection by the appropriate agencies. In these temporary storage and transfer places, wastes are subject to being eaten by animals, rained upon, picked over by human scavengers, naturally decomposed by micro-organisms and mixed with dust and dirt.

Given that waste generation is directly proportional to population growth are observable increase in urbanization has contributed to the solid waste problem in our settlement.

More resource use, more population agglomeration and the technology of mass production has given impetus to the generation of wastes under a climate of inadequate management responses. Thus, wastes has accumulated and now developed into a major problem.

The issue of poor environmental sanitation through inadequate refuse collection and disposal system has been a common feature of many Nigerian settlements. Wastes do not merely dot several parts of the major cities blocking motor roads, railways, alleys and pavements, they are indeed reference points, serving as sign post for traveling directions.

Estimates show that between 30-50% of the solid waste generated is often uncollected and disposed properly. There are wastes in drains, open lands and uncompleted buildings. Also the method of transporting the waste from one zone to another. These uncollected wastes provides breeding grounds for disease vectors.

The deplorable environmental condition must have led to conclude that; Nigerian rural and urban cities are reputed to be some of the dirtiest, the most unsanitary, the least aesthetically pleasing, the least safe and secure and mostly poorly governed cities in the world. The gloomy picture of our settlements should concern the environmentalists and city managers because it seems to be pointing accusing fingers at our failure to deliver functional, aesthetically sound and livable settlement. Inadequacy of waste disposal facilities in our cities and towns has compounded the problems of solid waste management. The facilities provided either communal depots or incinerators are overstretched by the growing number of people. (Kunle et al 1986), stated that rapid growth of the urban population means that many cities have now overflowed their boundaries. Consequently it is difficult for the cities authorities to plan properly for services provision and urban development.

Solid waste management in Nigeria is characterized by inconsistency in organizational and administrative structures. Constitutionally, solid waste management is responsibility of municipal or local government council, but in all states of federation today, Boards, Agencies and some authorities have been created for the purpose. For example, in the area of study (Paiko), the local councils has its workers responsible for sanitary, then came the various task forces on Environmental Sanitation by the then successive military governments.

Okpala (1986) observed that about the greatest constraint or the way of effective and quality solid waste management is the inadequate financing of the process and also despite the proliferation of towns and cities, solid waste management agencies in our cities lack technical manpower. The machines are inadequate and almost broken down. Most of these machines are imported. Kunle et al (1986) comment, the introduction of the high technology for solid waste management by the public sector in itself is questionable, considering the poor maintenance culture, lost of maintenance and spare part replacements, in the face of more appropriate ones, like wheel barrows, hand carts, small tippers and animals, to sum up the problem (Jehu 1999) said that existing governmental agencies responsible for solid waste management suffer from a group of related problem such as lack of technical manpower, fund and equipment.

CHAPTER 3

3.01 RESEARCH METHODOLOGY AND PROCEDURES

This study was carried out to identify the various problem of solid waste management using Paiko town as a case study. Data on the types, sources and characteristic of solid waste were collected.

In the course of this study, Paiko town was divided into two (Paiko North and south) using the two political wards. The Northern part comprises the central market (also known as Tsohon Kasuwa), Gbadna, Zapupi, Dhaphi, Kpari, Anguwan dan shanu, and Lugodan while Paipi, Tagopi, Zango, Sabon Kasuwa, Limawa makes up the Southern part of the town.

3.02 RESEARCH METHOD

To source for information, which allowed for in-depth study of the state of solid waste management in Paiko, the researcher employed descriptive survey method. This method allowed for information to be sourced concerning the current status, phenomena, or happenings. The method also describes, interprets and it is concerned with conditions and relationships that exist, opinions are held, evidence of effects, current and developing trends.

3.03 SAMPLES AND SAMPLE TECHNIQUES

As all inhabitants of Paiko cannot be reached, a total number of one hundred and sixty two (162) respondents were reached to administer questionnaire: This were either the head of households or their spouses. Where neither of them was not available, an adult who may be familiar or has sufficient knowledge about the researcher topic was given the questionnaire.

3.04 PROCEDURE FOR DATA COLLECTION

Various approaches were used to collect data in this research work. The researcher used both primary and secondary data in additional to other research instruments used in descriptive survey studies.

i. The Primary Data

This is made up of structured questionnaires. This questionnaires were structured in such a way that respondents can easily respond by ticking from the alternatives given to each question item.

Two types of questionnaires were developed and administered to Paiko residents and the body responsible for the collection and disposal of solid waste in the town.

A total number of 162 questionnaires were administered (120 copies for the public and 42 for body responsible for waste management). Out of the total number, eighty-five (85) were successfully returned.

ii. Secondary Data

The secondary data were sourced from textbooks, journals, unpublished materials, thesis, seminar papers, newspapers, published materials, reports and other appropriate literatures on solid waste management. The data was sourced and review in chapter two as literature review.

iii. Reconnaissance Survey

A visual survey of the area of study was carried out to observe and study the physical characteristics of elements concerning refuse collection and disposal.

These included the assessment of existing condition, dumping sites, the mobility of people and their activities around the site.

iv. Interview

Personal interviews were conducted with individuals directly involved in the management of solid waste particularly the staff of Paiko Local Government Health Department, Sanitation Unit.

The people interviewed were carefully chosen in stratified form to ensure validity and reliability of information received.

v. Data Analysis

For easy analysis of data, a representation of statistical information, a table was drawn to assemble data. The table was meant for the completed questionnaire forms received from the respondents. The responses were coded and fed into tables. The descriptive statistics of frequency and percentage were used for the final analysis. The frequency distributions summarized into table were converted into percentages for easy usage in the analysis.

CHAPTER FOUR

4.0 DATA ANALYSIS AND PRESENTATION

This chapter entails the result analysis and discussion of all the findings. The questionnaires were structured in line with the objectives of the study.

As earlier stated in chapter three, a total number of (162) one hundred and sixty two questionnaire forms for both the general public body responsible for waste management in the town (sanitation unit, health department) were sent out for administering on the respondents and only sixty two (62) forms were successfully attempted and reformed by the public and twenty three (23) forms meant for the sanitation unit were also reformed, making it a total of 85.

In the analysis of data, a simple frequency and percentages were used in the presentation.

4.01 SOURCES OF SOLID WASTE

TABLE 4.1 SOURCES OF SOLID WASTE

Source of Waste	PAIKO NORTH		PAIKO SOUTH	
	Frequency Distribution	Percentage (%)	Frequency Distribution	Percentage (%)
Domestic	18	60	18	56.25
Commercial	9	30	11	43.38
Institutional	3	10	3	9.37
Total	30	100	32	100

Source: field survey, 2002

This section of the data analysis deals with the source of the solid waste generated in Paiko.

From the survey conducted in table 4.1, it indicated that domestic waste recorded the highest percentage of waste compared to commercial and institutional waste. The institutional waste is very minute. The increase in population of the town is been indicated by highest amount refuse generated through domestic activities

TABLE 4.2 TYPE OF SOLID WASTE GENERATION

Type of refuse	Frequency distribution	Percentage %
Leaves and food	18	29.03
Papers and polythene.	34	54.84
Plastics	10	16.13
TOTAL	62	100

Source: field survey, 2002

On the waste composition in Paiko, the findings from the field survey on table 4.2 above, reveals that 29.03 % of the refuse generated are made up of leaves and food remnants. Papers and polythene recorded 54.84% of the waste generated while plastics materials represent the remaining 16.13%

Composition of the solid waste is usually affected by the level of income of the residents. Though Paiko residents can be termed as low and middle-income earners, the use of polythene and papers in both domestic and commercial activities is high. The table above table reveals that.

4.02 WASTE STORAGE

The refuse generated in residential and commercial areas in different places using different types of storage facilities. Table 4.3 is with the different types of storage facilities in the areas.

TABLE 4.3 TYPES OF STORAGE FACILITIES

Types	Frequency distribution	Percentage%
Refuse bin with lid	15	24.19
Drums/Bucket	20	32.26
Wheel Barrow	3	4.84
Cartons/Basket	24	38.71
TOTAL	62	100

Source: field survey, 2002

The storage facilities mentioned in table 4.3 are not adequate if more of such facilities are available, indiscriminate dumping of refuse will reduce and this will create a healthy environment.

On the hygienic nature of the storage facilities, survey reveals that the residents leave their refuse bins exposed (not covered) to the environment while others do cover theirs.

Survey also reveals that storage facilities are not adequate in the commercial areas especially the two major market areas including the central areas where some mini shops exists. Activities in this named area generate lots of waste materials.

4.03 WASTE COLLECTION.

The table below meant to find out who cleared or collect waste from the community waste dumps.

TABLE 4.4 **WASTE COLLECTION FROM DUMPING SITE**

Option	Frequency distribution	Percentage (%)
Local Govt. Authority	62	100
State Government	0	0
Private firm	0	0
Community	0	0
Others	0	0
TOTAL	62	100

Source: field survey 2002

From the survey findings, all the sixty-two (62) respondents indicated that once the refuse is taken out of the household to a dumping site it becomes the responsibility of the government (i.e. Sanitation Unit, Health Department) to collect the waste. As a follow up to the question, the researcher questioned some respondents on why government alone? From their responses they further affirmed that it was a social service expected to be provided by the government in any community.

4.04 **GENERAL COMMENT ON THE SURVEY OF WASTE COLLECTION IN THE TOWN.**

Survey reveals that there is no order of waste collection in the town. The official site located for the public by the Local Government Authority (sanitation division) has been ignored. It appears that any available open space is used as refuse dump. This is causing a lot of concern to the general public in terms of untidy nature of these dumps and the public health danger associated with them.

An example is the open space near the central market, which are plots of land owned by individuals for future residential development purposes, and so is the plot of land directly opposite the central mosque too. These lands are now been turned to a refuse dump.

There has been an attempt in the 80's to control refuse disposal and location of waste dumps in the town. Refuse collection points were provided at strategic point in the town where the public should dump their refuse.

This attempt has not yielded any encouraging result as the situation revealed the following:

A comparison between the size of a waste dump and the area it serves, shows that a high frequency of refuse removal from the dump is needed to prevent overflow of the solid wastes. It is necessary to provide these refuse collection bearing in mind the population density of an area.

Children sent to dump refuse (or adults in haste) do not dump refuse into the collector, but at any convenient point around the wall of the refuse dump. This will increase the work of the sanitation team in collecting the refuse for disposal. A proper education of the people at large is necessary.

In the course of this study it was observed that this structure used for the collection of these refuse are no longer in place. Some of these structures have been destroyed due to lack of proper attention.

Several unuttered road in the town especially the one leading to Kpari and Anguwan Zango have been rendered impassable because of refuse due to the fact that the refuse dump is not within the reach of people using the nearest outlet which is the roadside.

Survey reveals that the undeveloped plots of land in the town tends to attract people to use them as dumps. Fencing of such areas and strict surveillance will keep people away from dumping refuse.

From the data gathered in the course of this study it is obvious that official and non-official dumping sites exists. The official dumping site are the major sites provided and maintained by the health department.

The dumping sites are not many and those provided are sited very close to the residential areas. It was also observed that the management programme does not include recycling, land filling sites due to cost, and also no incinerators. It follows that not all waste management method are practiced before there can be efficient waste management.

4.05 DISPOSAL OF SOLID WASTE.

Survey reveals that the equipment and personnel being used at present to collect refuse from all dump in the town are not adequate and the existing ones are not of services to achieve the high frequency of refuse disposal.

Method adopted by the people in disposing refuse includes burning of the refuse. The refuse are gathered around the dumping site and burnt. During the application of this method, pollution of the air around the town is usually observed.

Observation and interview with the head of sanitation division for this section of the study reveals that sometimes, disposal of waste by the use of tractor, wheel barrow, dustbins and sometimes hired tippers are also involved due to inadequate equipment for such purpose. This are method employed by the local council in disposing refuse when the going was good but at present it is not so.

The different method of disposal adopted by the resident in Paiko are different (see table 4.5).

TABLE 4.5 **METHOD OF REFUSE DISPOSAL BY HOUSEHOLD.**

Method	Frequency distribution	Percentage %
Packing and burning	18	29.03
Open dumping	30	48.39
Dumping in drainage	10	16.12
Others	4	6.46
TOTAL	62	100

Source: field survey

Table 4.5 above is meant for the method employed by various households in the town in disposing refuse. The table shows that 29.03% of the respondents dispose their refuse by packing and burning, while 48.39% of the respondents carry their waste to the nearest commercial dumping site. 16.12% of the respondents throw waste into a nearby drainage. This often blocks the drainage. 6.467% use other means of disposal. None of the methods mentioned above is free from associated health hazard. Burning of refuse causes atmospheric pollution and can result in fire outbreak. Open dumps also pollute the atmosphere with odours emitting from the decaying organic component of the waste. It also attracts disease causative agents like rodents and flies

Open dumps on street impedes effective traffic flow as well as the pollution of underground water. From the presentation above it is not out of place to say that open dumping is being practiced in Paiko.

The findings agreed with Egunjobi's (1985) observation that we must not underestimate the role of habits, and attitudes of the people, hence the need for awareness. To this end, the researcher is of the view that ignorance, habit and attitudes of the people account for the food materials, cans, polythene, plastics and papers that litters the environment entirely.

TABLE 4.6 **WILLINGNESS TO PAY FOR REFUSE DISPOSAL**

Option	Frequency distribution	Percentage%
Willing to pay	36	58.1
Not willing to pay	25	40.3
No attempt.	1	1.6
TOTAL	62	100

Source: field survey, 2002

Table 4.6, provides information on respondent willingness to pay for refuse disposal services. From the survey findings it shows that 58.1% are willing to pay for the said services and 40.3% are not willing to do so. There is only 1.6% response from no attempt response of respondents. From the findings it is of the opinion of the researcher that responses that recorded higher percentage were based on health benefit while other reasons were base on aesthetics etc.

4.06 **THE PROBLEMS ASSOCIATED WITH SOLID WASTE MANAGEMENT IN PAIKO**

There are several problems militating against effective solid waste management in Paiko. These problems are multidimensional ranging from administration, political, technical and financial problems.

i. **Body Responsible for Waste Management.**

There is only one body responsible for solid waste management in Paiko. This is the sanitation inspectorate office under the Public Health Department of Paiko Local Government Council. The Public Health Department is backed up by the Niger State Public Health Law (Amendments) Edict No.2 of 1984 (see appendix A) there are lapses in the implementation of the provision of this law. Due to economic reasons the implementation of the provision of sector 1 of this law is very weak, as many household cannot afford to buy refuse bins for the collection of waste. In section II, III and VI, the fees or fines contained therein are too meager to make any impact on the offenders. This law needs to be reviewed and amended to suit the present reality. The government, after reviewing and amending this law should see to it that the provisions of this law are strongly on forced and adhered to by the department of health.

ii. **Sanitation Office.**

This exists under the public health department of Paiko local government. Despite their efficient and effective functions, there are still inadequacies in the execution of there function. Some of this

include lack of proper routine inspection by the officers of the sanitation office to identify nuisances that are injurious to health and tenants or owners of the premises served with an order to abate the nuisance within a given period.

There is lack of proper inspection of household in relation to refuse storage and disposal in the town, this is partly due to inadequate number of staff and partly due to weak monitoring of their activities by Niger State Environmental Protection Agency (NISEPA).

There is also the problem of relaxed enforcement of the sanitary laws and the prosecution of offenders, which has led to or encouraged indiscriminate dumping of waste all over the town. This is attributed to political reasons where some people feel that they are above the law because of their positions in the community.

Niger State Environmental Protection Agency (NISEPA)

This body is responsible for monitoring of environmental management in the state. The body is backed by Edit No.1 of 1996 (Agency Edit, 1996), (See Appendix B). The body is weak in the monitoring of the activities of the sanitation office in relation to waste management and also in the monitoring control, and prevention of environmental degeneration as provided by the edict. The edict is adequate to check environmental degeneration, if implemented properly. The laxity as a result of administrative bureaucracy and political reasons where officers find it difficult to challenge or report other officer's weaknesses in the performance of their duties.

iii. Lack of Finance

The role of a sound financial base is a pre-requisite for any organization to survive and carry out its functions in order to realize its set objectives. Money is needed to pay and maintain workers, purchase of specialized equipments in sufficient number needed for effective waste management and for operating and running of everyday activities. The only source of finance to the sanitation office is the budgetary allocation from Paiko Local Government. From an interview with the head of public health department, the amount being allocated to the department annually has been drastically cut down.

iv. Lack of Manpower

The number of trained environmental officers whose responsibility is to ensure effective coordination of the management system and general inspection of the town is also grossly inadequate (see table 4.7).

Some of the sanitary attendants (labourers) available are old people (inactive) whose productivity is declining.

TABLE 4.7 STAFF STRENGTH OF THE SANITATION UNIT

S/NO		
1	Health Superintendents	5
2	Health inspectors	4
3	Sanitation attendants (labourers)	9
4	Drivers	3
TOTAL		21

Source: field Survey, 2002

As at the time of this survey, the public health department had a total number of seventy five (75) staff out of which twenty one (21) staff were posted to the sanitation department (see table 4.7).

Based on the analysis carried out on volume of waste generation, more hands are needed to carry out the demanding exercise effectively.

v. Technical and Equipment

The few collection point available in Paiko are not logically and strategically located. The distance of the collection points to the point of refuse generation is considerable far, this has led to open dumping of waste on any nearby available open space. The residents resort to dumping refuse on the ground due to lack of collection bins. Lack of collection vehicles for effective collection and disposal of refuse in Paiko has been identified as one of the major constraints towards effective management of solid waste.

INFERENCE

Inference drawn from the analysis of the existing management system of solid waste in Paiko town is that the problems militating against its effective management is the administrative inefficiency of the bodies responsible for such function. These functions have not been fully implemented.

CHAPTER FIVE

5.0 SUMMARY, PROPOSAL, RECOMMENDATION AND CONCLUSION.

5.1 SUMMARY AND PROPOSAL

From the survey and analysis of the data obtained, it reveals that a number of factors usually determines the extent characteristics and consumption of solid waste generated. Among, such factors are size of population and density, education, attitude and habits of the people.

The survey shows that there are tons of accumulated waste that needs to be collected or cleared presently on ground. In view of this, a short-term measure needs to be taken to clear this waste. A period of one month is suggested for the refuse clearance exercise in the town.

On the nature of waste generation from this work, it shows that they are basically the same in all areas of the town. The composition of the waste in some areas of the town is attributed to the low level of income of the people.

Similarly, the solid waste generated in Paiko is mostly from the domestic activities with a sizeable position from commercial activities.

The study reveals that most of the unofficial dumping sites constitute eyesores and produce bad odours. There are no incinerators, no treatment of waste before final disposal except medical waste, which are burnt or buried in the ground. Also poor knowledge, attitude and habits of people on the basis of ignorance constitute major problem of indiscriminate disposal of waste and its management for an efficient utilization.

Above all, the most intricate problem to effective waste management has to do with poor funding by the government, but due to the magnitude of the waste generated, it has made things very difficult for the government alone to handle.

PROPOSAL

The survey of the town reveals that there are tons of accumulated waste that needs to be cleared or collected. A period of at least one month refuse clearance exercise is suggested. After the clearance, the followings are to be taken into consideration for future operation in the town. Vehicle of about 3 to 4 are required to clear the refuse expected to be accumulated during the clearing exercise.

At present, there are only 21 staff in the sanitation office. The number of staff is inadequate for effective management of waste. A suggested ratio, 5 labour men per thousand population (F.M.W.H., 1982), a 100 number of staff members are being suggested for the sanitation office to effectively manage the solid waste in the town (see table 4.8)

Table 5.0 Proposed Staff Strength

S.no	Category of staff	Number
1.	Trained environmental officer	20
2.	Health superintendents	16
3.	Drivers	7
4.	Health inspectors	12
5.	Sanitation attendants (labourers)	45
	Total	100

Source: field survey, 2002

5.2 CONCLUSION AND RECOMMENDATIONS

Solid waste problem is the most pressing environmental problems being faced by the society and the bodies responsible for its management. For its effective management in Paiko town, the government needs to place a high priority to the body responsible for its management. With this, the problem of solid waste management and preservation and insurance of cleaner environment, proper waste management must be one among government priorities. This can be done through adequate enlightenment programme. The budgetary allocation should be improved upon to curb the deficit finance problem that the management is experiencing.

It is indicated in this study that the household members collect waste/refuse from houses to dumping sites. Thus it is recommended that Government Agency or Local Government Council Environmental Unit should make adequate arrangement with residence in provision of dustbin and collection of waste on regular bases. The type of bin to be used for residential or commercial proposes must be approved by the Sanitation Office. Little fees can be charged on the service rendered to the public, which is now on practiced by commercial refuse collection unit under sanitation unit of Health Department of the Local Government.

The agency involved in the management must be effectively equipped with tools and there should be the involvement of private organization participation. The department responsible for waste collection, management, and disposal should be provided with enough funds to effectively carry out

its function adequately. In addition, there should be enough manpower both technical and otherwise including equipment and facilities should be provided.

The government should buy refuse bins and sell at subsidized rate to the residents of the town. They should also ensure that every household buys the refuse bins for refuse storage and collection. The type of bin to be used for residential or commercial purposes must be approved by the sanitation office.

Ensuring good environmental quality does not only lie in the hands of the Government alone. It is therefore recommended that, individuals interested in the protection of the environment should form pressure groups in the town. Their duty shall be to assist the public health department in enlightening the masses on the need for a clean and healthy environment.

In addition, the Niger State Environmental Protection Agency in conjunction with the sanitation office should draw up qualitative and quantitative standards of environmental quality management in the town. This would assist in ensuring good and healthy environment.

Staff welfare should be given priority by the government because this is a job most Nigerians would not live to do to earn a living especially the labour aspect. Improved welfare scheme would attract people to the job.

As regard to some of the waste generated and discarded or recyclable materials, government and private entrepreneurs should go into business of recycling the waste. The prospects for recycling is so bright in the sense that Egypt and other European countries waste is being recycled as raw materials. In Nigeria the rate of recycling is till at its lowest web but a sizeable number of young-men are already in to it.

In conclusion, the study examined the existing solid waste management practiced and the associated problems in Paiko Town. In the light of this, appropriate recommendations have been made which if implemented will solve the problems of solid waste in the town in the long run. Solid waste management should be seen as a high priority sector. This will alleviate the financial and other administrative inadequacies in the management of solid waste in the town.

Lastly, living in a healthier and cleaner environment would bring about sustainability of life and the environment in general.

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APPENDIX A

NIGER STATE PUBLIC HEALTH LAW

(Amendment) EDICT No. 2 of 1984

1. Every owner or occupier of any tenement shall provide dustbins for his/her tenement and same shall be used for depositing refuse of any description.
2. Every owner or occupier who shall fail to comply with the provisions of this section shall for each offence be liable to a fine of twenty naira and where the offence so committed by such owner or occupier in relation to shop or market stall, such shop or market stall, shall in addition to such fine be sealed up for period of two weeks from the date of such condition.
3. Where the offence is committed by a corporate body, it shall be liable to a fine of two hundred and fifty naira for each offence.
4. Notwithstanding, the provisions of any other law or enactment a magistrate of Area court judge of any grade shall have jurisdiction to try summarily any of the offences stated under this edict.
5. The provisions of this section shall apply to any town ship within the state.
6. Any person who commits any nuisance in any street or any open space or any pace being an appurtenance or adjoining a dwelling house shall for each offence in addition to any liability for damage at the suit of any person aggrieved, be liable to a fine of fifty naira.

APPENDIX B.

FUNCTIONS OF NIGER STATE ENVIRONMENTAL PROTECTION AGENCY

EDICT No. 1 of 1996 (Agency Edict, 1996)

The agency shall subject to this edict, have responsibility for the protection of the environment, biodiversity and sustainable development in the state and shall:

1. In conjunction with FEPA, ensure implementation and enforcement of FEPA regulations in the state and in particular ensure the carrying out of annual state of environmental report.
2. Conduct public investigation on major environmental pollution
3. Cooperate with both state and federal ministries on matter relating to environmental protection.
4. Prevent any act of omission or commission which consequence are likely to adversely affect the environment and to generally deal with any discharge solid, liquid or gaseous, deposited with fully or otherwise on the environment.
5. Monitor environmental quality; conduct programmes of continuing surveillance and regular periodic inspection of actual or potential contaminants.

**SCHOOL OF POST-GRADUATE
DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA.**

**Questionnaire for the Body responsible for collection and disposal of refuse in
Paiko town .**

Organization.....

Date.....

**STUDY AREA: SOLID WASTE MANAGEMENT IN PAIKO TOWN
PROBLEM & PHYSICAL PLANNING.**

A research work is proposed to be done on the above topic in pursuit of Postgraduate Diploma. The aim of this preliminary survey is to obtain useful information needed for the success of the research. Therefore, your candid responses to the inquiries is highly solicited for, as well as your co-operation for the next stage of the study. All information obtained would be treated with strict confidence and only for the purpose of the research .

INSTRUCTION:

1.0 COLLECTION POINTS.

1.1 How many collection points do your have in Paiko?

1.2 What is the nature of the collection point?

- (a) Enclosed () (b) Open () (c) Walled ()
(d) Others (Specify)

1.3 Where are the collection points located.

- (a) Along the streets/road (b) Within accidental open spaces
(c) Within planned space (d) Others (Specify).....

1.4 What problems do you encounter in the siting of collection points.

2.0 VEHICLES

- 2.1 How many Vehicles do you have for refuse collection?
- 2.2 What type of Van or refuse Vehicles do you have?
(a) Trucks (b)Tippers (c) Tractors (d) Others (Specify).....
- 2.3 What is the carrying capacity of each Van?
- 2.4 How often do you go out for refuse collection?
(a) Daily (b) Weekly (c) Others (Specify)
- 2.5 What are the problems encountered during collection?

3.0 DISPOSAL SITE

- 3.1 How do you finally dispose refuse after collection?.....
(a) Land fill () (b) Ordinary Dumping () (c) Composting ()
(d) Others (Specify).....
- 3.2 How many disposal sites do you have in Paiko?
- 3.3 What is the criteria for choosing these sites?
- 3.4 What are the problems you encounter during disposal?.....

4.0 OTHER MATTERS

- 4.1 What major problem is the body facing in collection, transportation and disposal of refuse?
(a) Level of finance () (b) Low level of staff strength ()
(c) Inadequate equipment () (d) Lack of access to collection points ()
- 4.2 What steps are being taken to solve these problems?.....
- 4.3 What is the source of finance to the body?

**SCHOOL OF POST-GRADUATE
DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA.**

Preliminary Questionnaire For The Public –

**STUDY AREA: SOLID WASTE MANAGEMENT IN PAIKO TOWN
PROBLEM & PHYSICAL PLANNING.**

A research work is proposed to be done on the above topic in pursuit of postgraduate diploma. The aim of this preliminary survey is to obtain useful information needed for the success of the research. Therefore, your candid responses to the inquiries is highly solicited for, as well as your co-operation for the next stage of the study. All information obtained would be treated with strict confidence and only for the purpose of the research .

INSTRUCTION

Tick or fill (✓) in the space as appropriate.

1. Size of House hold
(a) 1-5 () (b) 6-10 () (c) 11 and above ()

2. What are the sources of your refuse ?
(a) House hold activities () (b) Commercial activities ()
(c) Industrial activities ()

3. Types of solid waste generated
(a) Food materials () (b) Ashes and dust ()
(c) Metal scraps and can () (d) Polythene and paper ()
(e) Plastic and ceramic () (f) Others (specify) -----

4. How do you dispose your refuse?

- (a) Through burning () (b) Open dumping site ()
- (c) Incinerators () (d) Drainage ()
- (e) Others specify -----

5. Do you dispose your waste immediately ? Yes () / No ()

6. If No, where do you store your waste before disposal ?

- (a) Dams (b) Bucket (c) Baskets (d) Sacks.

7. How frequent do you empty your Dustbin ?

- (a) Daily (b) Every 3 days (c) Weekly (d) Monthly

8. What establishment or agency is responsible for the collection of refuse ?

- (a) Local Government Authority () (b) State Government ()
- (c) Private Firm (d) Community () (e) Others specify -----

9. If method of disposal is open dumping, are you satisfied with the location ?

Yes () / No ()

10. If No, what do you feel should be the best alternative ?

- (a) Provide incinerators () (b) Provide more lids containers ()
- (c) Others (Specify) -----

11. What major problems do you encounter with the firm of refuse disposal in your area ?.....

.....

12. Do you pay fee in respect to the collection of your waste ?

Yes () / No ()

13. If Yes, how much.....

14. If No, are you willing ? Yes () / No ().