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Effective Solid Waste Management: A Panacea to Disease Prevention and Healthy Environment in Bayelsa State, Nigeria

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The problem of waste management has become a debilitating factor towards preventing diseases and sustenance of healthy environment. Waste is considered as material which arises from animal and human life activities, which is discarded as useless and unwanted, that can attract pathogenic organisms causing disease and unhealthy environment. The paper reviewed the concepts of waste, sources of waste, types of wastes, concept of waste management, methods of waste disposal, the challenges for effective waste management, consequences of poor solid waste management and its impact to disease prevention and sustenance of healthy environment It was concluded with few suggestions made; that waste management should be provided with a separate head in the budget for the purpose of adequate revenue allocation, implementation, and monitoring. The participation of the local communities in waste management should be encouraged. Environmental health enlightenment campaigns should be intensified by both the state and local governments. All primary, secondary and tertiary schools curricula should inculcate detailed topics on environmental health education. Appropriate government agencies should enforce the environmental laws or policies toward achieving the goal of prevention of diseases and sustenance of healthy environment.

Key words: Solid waste, Waste Management, Challenges, Health Hazards, Disease prevention, Healthy environment**.**

INTRODUCTION

The management of solid waste, perhaps, stands as the most visible environmental problem facing the capital and communities of Bayelsa State. The problem is growing daily as a result of increasing urbanization. The solid waste problem is visible in most parts of the communities within the Yenagoa metropolis, on the roads, within the neighbourhoods and around residential buildings. The environment of man lies at the mercy of both natural disaster and negligence on the part of man in the course of controlling the gifts of nature. The later takes the form of dumping solid waste in an uncompromising pattern, that can cause; desert encroachment, erosion, depletion of ozone layer, depletion of natural resources, pollution of land, rivers, the air and generally the environment (Aguwanba,1998). According to Egunlobi (2004), in the early times (pre- colonial days) up till 1970s, the disposal of refuse and other waste did not pose any significant problem. The population was small and enough land was available for assimilation of waste. Solid waste problem started with urban growth, resulted partly from national

increase in population and more importantly from immigration. Ndakara (2011) also states that the quantity of such waste depends mainly on location, activity and number of people in the household.

However, it was not until the mid- 19th century, spurred by increasingly devastating cholera outbreaks and the emergence of a public health debate that the first legislation on the issue emerged. Thus the social reformer, Sir, Edwin Chadwick's 1842 report on "The Sanitary Condition of the Labouring Population, became influential in securing the passage of the first legislation of waste clearance and disposal, in which he argues for the importance of adequate waste removal and management facilities to improve the health and wellbeing of the city's population. (Barbalace, 2003).

Early garbage removal trucks were simply open bodied dump trucks pulled by a team of horses. They became motorized in the early part of the 20th century and the first closed body trucks to eliminate odours with a dumping lever mechanism were introduced in the 1920s in Britain. These were soon equipped with "hopper mechanisms" where the scooper was loaded at floor level and then hoisted mechanically to deposit the waste in the truck. The Garwood Load Packer was the first truck in 1938, to incorporate a hydraulic compactor (Herbert, 2007).

Mba (2003), noted that no town in Nigeria especially the urban and semi- urban centres of high population density can boast of having found a lasting solution to the problem of filth and huge piles of solid waste, rather the problem continues to assume monstrous dimensions. To urban and city dwellers, public hygiene starts and ends within their immediate surrounding and indeed the city would, take care of itself. The situation has so deteriorated that today the problem of solid waste management has become one of the nation's most serious environmental problem (Okpala, 2002).

Ineffective waste management could rubbish all the resources and efforts put in beautifying the environment. Every year, the government of Nigeria, Bayelsa state inclusive spends billions of naira to roll back malaria, without focusing on some environmental factors such as poor waste management that makes malaria to thrive. Blocked drains provide stagnant water which facilitates the breeding of mosquitoes and other sickness causing germs (Ogadimma, 2011).

OBJECTIVE OF THE PAPER

The aim of this review was to examine the effectiveness of waste management as a panacea to disease prevention and healthy environment in Bayelsa state. Specifically it seeks to:

1. Examine the effectiveness of waste management in Bayelsa state.
2. Examine how proper waste management can prevent disease and sustain healthy environment.

Theoretical Framework

This review is anchored on the system theory and Waste management theory: System theory generally looks at the inter - dependence, and inter-connections of different parts to sustain, or encourage the harmonious function and stability of the system. Waste management as a part of the entire system within the society could have implications on health, environment and even climate change if not well planned by the government. So waste disposal becomes as important as water and electricity or provision of other infrastructural facilities within the society (Ogadimma, 2011). The theory of waste management is based on the consideration that waste management is to prevent waste, causing harm to human health and the environment, and application of waste management leads to conservation of resources (Pongraz, Philip & Keiski, 2004).

Concept of Solid Waste

Douglas (2004), describe waste as materials which arises from animal and human life and activities and is discarded as useless and unwanted. Thus waste includes all items that people no longer have any use for, which they either intended to get rid of or have already discarded. Solid waste means any garbage, refuse, sewage-sludge from a wastewater treatment plant, or air pollution control facility and other discarded materials including solid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities. Simply put- Solid wastes are any discarded or abandoned materials. Solid wastes can be solid, semi-solid or containerized gaseous material. (Department of Environment Conservation). The World Health Organization (2008), also refer to waste as "something which the owner no longer wants at a given time and space and which has no current or perceived market value. This present a broad based definition towards the classification of what constitute waste. However, what one regards as waste may not be totally useless, as much can be recycled to produce new products.

According to Areme, Osazuwa, and Nduka, (2007). Waste generated in the country were characterized by a high percentage (60-80%) of domestic and commercial waste. This gives the waste high density and makes them very attractive to flies, cockroaches, rats, and other vermin. Thus the defective strategies and arrangements adopted for solid waste management in Yenagoa,

Bayelsa State create erroneous impression that urban waste management problems are intractable. This sterns from the fact that the rate of collection and evacuation perpetually lag behind the rate of generation which makes solid waste accumulation a major source of environmental nuisance within the Yenagoa metropolis.

Concept of Waste Management

Waste management is the "generation, prevention, characterization, monitoring, treatment, handling, reuse and residential disposal of solid waste." Also according to Omuta, (1988). Solid waste management concerns the interplay, among generation, storage, collection and final disposal. Waste is introduced into the environment due to the day-to-day activities of humans. There are various types of solid waste including municipal (residential, institutional, commercial), agricultural, and special waste (health care, house hold hazardous waste, sewage sludge). The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics (Waste Management, 2013). Waste needs to be managed in order to prevent contact with humans and their immediate environment. Therefore, the main purpose of waste management is to isolate waste from humans and the environment, and consequently, safeguard individual, family and community health. In addition the aesthetic value of a better outlook and a clean physical environment is important for our emotional wellbeing.

Rodgners (2011), contends that waste management is a systematic control of generation, storage, collection, transportation, separation, processing, recovery and disposal of solid waste. In the smallest of places, solid waste management is accepted as a major aspect of the indigenous community organization and traditional home management; hence every house, compound has a designated area for solid waste collection/disposal and or incineration (Sanda, 2008). There is a wide array of issues relating to waste management and those areas include: Generation of waste, waste minimization, waste removal, waste transportation, waste treatment, recycling and reuse, storage and collection, landfill disposal, environmental considerations, policy and regulations, education and training, planning and implementation.

There are a number of concepts about waste management which vary in their usage between countries or regions. Some of the most general, widely used concepts include: Waste hierarch**y;** the waste hierarchy refers to the "3Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstones of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste, (Barbalace, 2003). Table 1

Generally, waste could be liquid or solid waste. Both of them could be hazardous, and solid waste types can be grouped in to organic, re-usable and recyclable waste as stated below

Liquid Type: Waste can come in non-solid form. Some solid waste can also be converted to a liquid waste form for disposal, Examples of liquid waste include wash-water from homes, liquids used for cleaning in industries and waste detergent.

Solid Type: Solid waste predominantly, is any garbage, refuse or rubbish that we make in our homes and other places. These include old car, tiers, old news papers, broken furniture and even food-waste.

Hazardous Type: Hazardous or harmful waste are those that potentially threaten public health or the environment. Such could be inflammable (can easily catch fire), reactive (can easily explode), corrosive (can easily eat through metal) or toxic (poisonous to human and animals. Examples include fire extinguishers, old propane tanks, pesticides, mercury- containing equipment (e.g thermostats) and lamps (e.g fluorescent bulbs and batteries).

Organic Type: Organic waste comes from plants or animals sources. Commonly they include food waste, fruit and vegetable peels, flower trimmings and even dog poop can be classified as organic waste. They are biodegradable (this means they are easily broken down by other organisms over time and turned in to manure).

Recyclable Type: Recycling is processing used materials (waste) in to new, useful products. This is done to reduce the use of raw materials that would have been used. Waste that can be potentially recycled is termed "Recyclable waste."Example are Aluminum products (like soda, milk and tomato cans), plastics (grocery shopping bags, plastic bottles), Glass products (like wine and bear bottles, broken glass), Paper products (used envelopes, news papers and magazines, cardboard boxes), can be recycled and fall in to this category.

METHODS OF SOLID WASTE MANAGEMENT

Solid waste management practices can differ from developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management of non-hazardous metropolitan areas is usually the responsibility of the local government authorities, while management of non- hazardous

Table. 1: Sources and Types of Solid Waste

Source	Waste Generators	Type of Solid Waste
Residential/ Domestic	Single and multi-family dwellings	Food-waste, paper, cardboard, plastics, textiles leather, metal ashes, special wastes(e.g bulky items, consumer electronics, batteries oil, tires) and household hazardous wastes (e.g paints, aerosols, gas thanks, waste containing mercury, motor oil, cleaning agents).
Commercial	Stores, hotels, restaurants, markets, office building, parks, beeches, areas	Paper, cardboard, plastics, wood, food-waste, glass, hazardous waste, general wastes from parks and beeches, e-wastes(e.g computers, phones television etc.
Institutional	Schools, hospitals,(non-medical waste), prisons, government buildings, air ports	Same as commercial
Medical-Services	Hospitals, nursing homes, and clinics.	Infectious waste (bandage, gloves, cottons, swabs, blood and body fluids), hazardous wastes (sharps, instruments, chemicals), radioactive waste from cancer therapy, pharmaceutical waste.
Agricultural Activities	Crops, orchards, vineyards, daries feedlots, farms.	Spoiled food waste, agricultural waste (e.g rice husks, cotton-stolk coconut -shells, coffee waste), hazardous waste (e.g pesticides).

Source: Chardwick (1842), Report on sanitary conditions.

commercial and industrial waste is usually of the responsibility of the generator subject to local, national or international authorities (Hoornweg, Lan & Chandhry, 2005).Waste management simply means the collection, transportation, processing or disposal, managing and monitoring of waste materials to minimize it's consequences on humans and the environment. There are several methods of managing all the various types of waste,(Hoornweg etal, 2005).

Generation of Waste The growth of human population couple with increased economic activities in the city and communities of Bayelsa state had resulted in high rate of solid waste generation. A fundamental attribute of solid waste is that, it is inevitable as almost every human activity involves the generation of waste in solid, liquid and gaseous forms. Social dynamics such as modernization and economic resource allocation had forestalled a mismatch between the rate of waste generation, rate of collection and disposal (Johnson, 2010).

Waste Storage, Collection, Transportation and Disposal Methods

Refuse storage, collection and management has continued to pose a major challenge to both developing and developed countries. Transport of waste from households, and other generation sites is a growing problem. The management of solid waste is far from being satisfactory in Bayelsa state. Many parts of the city and communities do not benefit from any organized waste management services and therefore wastes are unattended to, buried, burnt or disposed haphazardly. In areas where the Authority do the collection, it is often irregular and sporadic. Recycling of waste is negligible while the methods used for collection, transportation and final disposal are unsatisfactory.

However the Government of Bayelsa state have adopted different methods of solid waste disposal. One time contractors were assigned to evacuate solid waste from various dumps, and recently solid waste conversion vehicles are used by the Environmental Sanitation Authority and yet it is not uncommon to informal waste collectors using local vehicles (push carts) for collection services from door to door within the state capital constituting a major health hazard in the Yenagoa metropolis. Figure 1

It is believed that the refuse disposal vehicles are inadequate and substandard (exposed sanitation truck as seen in Figure 2, below). The areas that are more susceptible to the endemic problem are along the road

Figure 1: Locally Constructed Waste Disposal Push Cart.

Figure 2: Exposed Sanitation Waste Disposal Truck Along Sani Abacha Express Way.

sides of Amarata, Ekeki, Opolo market, and Swali market dumps, and worst of all at Edepie community off Tombia Amassoma road, which is used as the central refuse dump for the entire Yenagoa metropolis, have turned to a good feasting place for vultures and scavengers, causing nuisance to motorists, air pollution and making the entire environment stinking and uncomfortable for human beings to live and could contribute to contracting diseases as well as leading to unhealthy environment.

The Integrated Solid Waste Management

Integrated solid waste management, reflects the need to approach solid waste in a comprehensive manner with careful selected and sustained application of appropriate technology, working conditions, and establishment of a "social license" between the community and designated waste management authorities (most commonly local government). Integrated solid waste management is based on both a high degree of professionalism on behalf of solid waste managers, and on the appreciation of the critical role that the community, employees, and local (and increasingly global) ecosystem have in effective on solid waste management, (Shekdar, 2009). Integrated solid waste management is based on the hierarchy of waste management: "reduce, reuse, recycle" often adding a fourth "R" for recovery. A good example is the combustion method which is the controlled burning of waste in a designated facility to reduce its volume and in some cases, to generate electricity. This is a best option for waste that cannot be recycled or composted These waste diversion options are then followed by incineration and landfill, or other disposal options.(Tim, 2008).

These integrated solid waste management practice is not feasible for now in Bayelsa State since it is still a baby state in terms of environmental sustenance which might be due to lack of appropriate equipments. Most

importantly the attitude of people (inhabitants) especially traders, dump their refuses carelessly without adhering to environmental sanitation guidelines. These negative attitude is more obvious, seeing sanitation dump sites, meant for refuse disposal built at strategic places within the Yenagoa Metropolis, yet individuals with no regard for maintaining healthy environment will prefer dumping their refuse in a haphazard manner, not minding the stinking odour it might produce and the possibility of attracting micro- organism to feast on the solid waste, that can cause diseases to human beings as well as creating an unhealthy environment.

Waste Reduction Method: Recently, as many people have come to appreciate the need to do something about waste, there have been increased efforts to embark on source reduction schemes. According to the United States Facts and Figures (2012), on municipal solid waste generation, recycle, and disposal; source reduction is simply a range of activities that individuals, communities and manufacturing establishments engage to reduce the amount of toxic substances or waste that they generate. Examples include: (1) Manufacturers can reduce the amount of package and wrapping materials they use on products. (2) Produce materials that last longer, rather than cheap stuff that break after a short period. (3) Manage organic waste such as food crops, and yard trimming in ways that can keep them out of the trash bin. For example, Coca Cola has reduced the weight of its can by 41% since 1963, by reducing its aluminums usage and also shaving off some part of the cans.

Waste Recovery Method: This is the reclaiming of "trash" materials that have for so long be considered as waste and destined to the landfill. It involves collecting, sorting (and sometimes grading) and processing of waste in to compost or new raw materials that are used in manufacturing new products. The most used waste programmes involve energy recovery, recycling and composting, (Turan, Coruh, Akdemir, & Ergun, 2009).

Energy Recovery: This involves the conversion of non-recyclable waste into usable heat, electrification, or fuel through a variety of processes, including combustion, gasification, or otherwise, and further converted into useable energy. This process is called " Waste to Energy" (WTE). Energy recovery from waste is part of the non- hazardous waste management hierarchy. Using energy recovery to convert non-recyclable waste materials into electricity and heat, generates a renewable energy source and can reduce carbon emissions by offsetting the need for energy from fossil sources as well as reduce methane generation from landfills. In 2011, about 29million tones of MSW (12%) were combusted for energy use, generating over 2700 Mega watts of power per day. Globally, waste- to- energy accounts for 16% of waste management, (National Waste Recovery Association, 2012).

Recycling; is a resource recovery practice that refers to the collection and reuse of waste materials. It involves the conversion of waste or used materials such as glass, metal, paper, aluminum, plastics, and others into their raw material state to use again. Re-use means the use of a product on more than one occasion, either for the same purpose or for a different purpose, without the need for reprocessing. This avoids discarding a material to a waste stream when its initial use has concluded. It has become a very important function of many waste management and environmental organizations recently, because it has helped reduced our dependence on fresh raw materials, and saved a huge chunks of waste that would have ended up in landfill, reduced quantity of disposed waste (Saeed, Hassan, & Mujeebu, 2009).

Composting: This is a recovery process that involves the conversion of organic waste (food waste), with the help of bacteria, moisture and aeration. Composting ends up compost, a high-nutrient soil type that is used to fortify farm soils. Heat can be extracted from large composting units, which is an added bonus to the facility. Over the past decades, education, information and public engagement especially in developing countries, has yielded some interesting results. In 1996, 27% of Municipal Solid Waste (MSW) was recovered in the U.S.A, exceeding the national goal of 25% set by the U.S. Environmental Protection Agency (EPA). In 2012, Americans generated about 251 million tons of trash and recycled and composted almost 87 million tons of these material equivalents to a 34.5 percent recycling rate. (United States. Facts and figures, 2012).

Waste Prevention and Minimization: Prevention is the most desirable waste management option, as it eliminates the need for handling, transporting, recycling or disposal of waste. It provides the highest level of environmental protection by optimizing the use of resources and by removing a potential source of pollution. Minimization includes any process or activity that avoids, reduces, or eliminates waste at its source or results in re-use or recycling. For example, encouraging consumers to avoid using disposable products (such as disposable cutlery), removing any food or liquid remains from cans and packaging, and designing products that use less material to achieve the same purpose (Laoye, 1979).

Incineration Method of Waste Disposal: This simply means burning waste. This method is common in countries with limited landfill areas. Incineration chambers can be small for domestic use, but there are

large ones for municipal use as well. It is great for treating waste with contamination (like those from hospitals) and hazardous waste from factories, but the method produces too much carbon dioxide. Modern incineration processes are more efficient and releases less dioxin than home fire places and backyard barbecues. This method is effective but expensive, (U.N-Habitat, 2009).

Sanitary Landfills as Waste Disposal: Generally this term means a large piece of land away from living places where all the waste from a town is deposited. This involves burging the waste. But there is more to landfills. Proper landfill management involves sorting out all the waste (waste separation), and sending only the waste that can not be recycled and composted to the site. Proper landfills are also lined at the bottom to minimize the leakage of soil pollutants and other toxins from getting in to the water table. Landfills were established in abandoned or unused quarries and borrow pits. This method is effective, but expensive and difficult, (Graiser, 2007).

In many towns like the Yenagoa Metropolis, sorting out is not done, and all the waste for example, (papers, food, diapers, glass) is mixed up and deposited. That is a problem because, glass, and plastics take thousands of years to decompose. Additionally, the landfills soon become full, smelling and unsafe for the environment, as well as predisposing the lives of human beings to various forms of infection such as air borne diseases, that can affect the respiratory system, gastro intestinal tract infections, among others, since the environment has turned to be a feasting ground for micro organisms. Proper waste management is not cheap, but is something we all have to get involved and discuss it. The effect of not getting involved can be catastrophic to our health and the environment, (Solomon, 2009). See Figure 3.

A properly designed and well managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills such as the type in Bayelsa State, can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin and generation of liquid leachate. Another product of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste and breaks down anaerobically. This gas can create odour problems, kill surface vegetables and is a greenhouse gas, (Ezema, 2009).

Challenges of Waste Management in Bayelsa State

The management of waste is one of the major challenges confronting city managers globally. In Nigeria the rural-urban migration pattern for greater economical and social opportunities has compounded the waste generation and disposal challenges of these cities. Solid waste management remains one of the most daunting environmental sanitation challenges facing the Bayelsa State capital today and it has continually remain at its lowest ebb despite huge investments in the sectors. Currently as a result of urbanization and rapid population growth in the cities of Bayelsa State, wastes are generated faster than they are collected, transported, and disposed. This problem of urbanization has also compounded the problem of waste management as land becomes scarce, human settlements encroach upon landfill space, and government in some cases encourage new development directly on top of operating on recently closed landfills.

It is a well known fact that one of the consequences of production and consumption is waste management. How ever, this singular reason can not prevent people from production and consumption activities. According to Engner and Smith (2002). During the pre- colonial resolution, production and consumption was equally low, and its management did not constitute any serious challenge. In Nigeria, this popular lifestyle or habit of “Use once and throw away” have become so fashionable to the extent that it has posed so much challenges of sustainable waste management (Uwadiegwu & Chukwu, 2013). According to Hoornweg and Thomas, (1999). In solid waste management there is no “away”. When throwing away waste, system complexities and the integrated nature of materials and pollution are quickly apparent. For example waste incineration is expensive and poses challenges of air pollution and ash disposal. This situation has caused a disproportion in the rate of solid waste collection and evacuation and that of generation, which had contributed to waste accumulation as a major source of environmental nuisance in Nigeria, of which Bayelsa State is not an exception.

Waste management in cities with developing economies experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening. Hence there is serious need for adequate and sustainable management strategies in handling the waste generated, from the process of production and consumption. Unfortunately, within the Yenagoa metropolis of Bayelsa State, the management of waste has continued to be poorly handled. Aguwanba (1998) also noted that the state environmental agencies have been hampered by poor funding, inadequate facilities, human resources, inappropriate technology and an inequitable taxation system, and some of the waste management staff are poorly trained and does not make use of personal protective equipments, such as hand gloves, face masks, spectacles, and safety boots while coming in contact with waste materials. In addition to these limitations, are the ever increasing challenges of rapid population growth

Figure 3: Central Dump Site, Off Amassoma Road, Edepie-Yenagoa.

rate and poor planning, which has not only affected solid waste volume but also made solid waste management strategies incapable of keeping pace with the rate of generation.

Landfills require land availability, and the setting is often opposed by potential neighbouring residents. Solving one problem often introduces a new one, and if not well executed, the new problem is often of greater cost and complexity. Locally, waste collection vehicles are large sources of emissions and both incineration and landfilling contribute “greenhouse gas. Uncollected waste can provide breeding areas and food to potentially disease carrying vectors such as insects and rodents, with their associated health and nuisance issues. Waste management cannot be effectively managed without due consideration for issues such as the city’s over- all Green House Gas (GHG), emissions, labour market, land use planning, and myriad related concerns(Pepera, 2003). Other problems facing waste management are as follows: No system of primary collection from the doorstep, no storage of waste at source, irregular sweeping, poor waste storage depots and the use of traditional handcarts/ tricycles that carries waste, spills over which are both unsightly as well as unhygienic (Smith, 2005).

Consequences of Poor Solid Waste Management

The Vanguard News Paper publication of Thursday January 30th, 2014, unveiled a new environmental sanitation policy of 17th April, 2012 with the empowerment of the State Environmental Sanitation Authority as an autonomous body and cancellation of contract removal of waste in the Bayelsa state capital. The government which declared a state of emergency on the issue of waste in the state assured that the dirty status of the state capital would soon change. The new sanitation policy include: the introduction of a new bagging system for refuse, a specific time of between 6-7pm for disposal of refuse at public bins and the setting up of a task force to arrest individuals littering the road with sachet and other waste. The current chairman of the Environmental Sanitation Authority, Chief Ebifemowei Abel, during a sensitization tour of the gathering of professionals, politicians and media practitioners under the aegis of “ The Paliament” in Yenagoa, said the new sanitation policy by the state government was conceived to improve the sanitary condition of the state, even though the new administration in the state met a poor sanitary condition with offensive odour spreading around the state capital. It is not going to be business as usual, and vowed to sustain a system that will ensure that the state capital attain the status of one of the cleanest in the country.

But it is pertinent to mention that, in Bayelsa State, the volume of solid waste have assumed such alarming proportion that some households have turned their backyards and along the roadside as waste bin, where all manner of waste are dumped, without regards for the environment and associated health impacts. The dumping of waste on the river and stream, constitutes a serious problem because the waste has the potential of polluting these water source, which some of the households use for their domestic supply, which have constituted serious, environmental and health impacts, such as air pollution that can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs in to other parts of the body. Adelegan (2001), also opined that inadequate, improper sanitation and poor solid waste management remain to be the main transmitters of diseases in the world’s developing countries like Nigeria.

Although the relationship between solid waste and

disease is difficult to prove, however improper handling of solid waste is a health hazard and causes damage to the environment. The main risk to human health arise from the breeding of vectors, primarily flies, and rats, which acts as a transmission route of some diseases such as bacillary dysentery, amoebic dysentery and diarrhea to human through contaminated food and water (Rao, 2006). In addition hazardous wastes are injurious to human health, some have acute effects, while others pose a health hazard after prolong period of exposure. Improper disposal of such waste can result to the death of humans and animals through contamination of crops and water supply sources. The environmental damage caused by solid waste is mostly aesthetic in nature. Uncontrolled dumping of urban waste destroys the beauty of the state capital, produce bad odour and could cause serious flooding if allowed to block drainage channels. A good example is the 2012 flood that affected the entire state, which was made worst by the blocked drainage and canals that impaired free flow of water, resulting to stagnation/ flooding.

Waste when left unattended for a long time constitutes serious hazard, causes offensive odour, pollutes underground water sources and decreases environmental aesthetics quality. Also leachate from waste disposal dumps can pollute both surface and ground water sources, which could constitute a serious health challenge to man (Ohwo, 2011). Furthermore, uncontrolled burning of open dumps can cause air pollution, increase greenhouse gas emission, which contributes to climate change. According to Ogadimma (2011).The type of waste and the method of its collection and disposal within the society have negative impact on the climate through the emission of gases. The management or mismanagement of solid waste in the cities does not only predispose them to natural disasters as a result of climatic change, it actually leads to climate change through the emission of dangerous gases to the atmosphere.

In fact, in most State governments, Bayelsa state inclusive, do not have a well structured refuse collection and disposal system on ground to proactively handle the management of waste within the capitals alone not to talk of other major cities in the state. In Bayelsa , garbage is collected by either government agency or private refuse collectors. Sometimes these private collectors lack the equipment and capacity to handle the waste generated in these areas leaving the public to suffer the health hazards such polluted environment portends. The waste burden has indeed become critical with products often containing materials that are toxic and not readily biodegradable. Such material include: various types of industrial chemical wastes, which can contaminate soil and underground water sources indefinitely, if not properly disposed. Biomedical waste from health care institutions also contains infectious/ hazardous materials that can pose potential hazards to the environment and human health, when not properly disposed. The improper handling and disposal of medical wastes is a major threat to refuse collectors and scavengers, and can result in infections such as HIV/AIDS, Hepatitis, Tetanus, and cholera among others, (Prerera, 2003). According to Bodija and Oluyole (2004).Upgrading the coverage of modern waste disposal system and services and increasing their efficiency is a precondition for improving the environmental quality of the urban centres.

The Need for Environmental Education, Awareness and Public Participation

According to Emeribe (2000).Environmental education is necessary for improving environmental quality. Much of traditional solid waste management practices such as waste burning, indiscriminate open dumping of waste, ecological ideals and government regulations often arouse conflict. Enlightened debates, public awareness and even outright opposition can promote a forum for dialogue and conflict resolution which can lead to balanced policies, which will enhance public commitment. Such a system that involves peoples participation is democratic. A better understanding of solid waste management and its attendant problems will enhance the effective use of the environment. Although people are capable of influencing their environment in both constructive and destructive ways, yet, much of the influence has been in the service of making the environment less attractive and unhealthy.

People are depleting natural resources and polluting the environment at an alarming rate and it is, therefore important to educate people better in order for them to have positive attitude, commitment and motivation to adopt sound techniques in managing their waste products. According to Emeribe (2000), environmental education and awareness among decision makers will considerably help in a better integration of environmental issues, such as integrated solid waste management practice that can help in disease prevention and sustenance of healthy environment.

CONCLUSION

To achieve the goal of disease prevention and healthy environment in Bayelsa State, it requires efficient management of solid waste. Therefore the need for an adequate waste management strategy in any community or state capital cannot be over emphasized, because inadequate waste management has its associated negative impact on the environment and human health. Solid waste management in Bayelsa State requires the concern of government, businessmen, politicians,

religious organization, civil servants, men, women, literate, illiterate, the rich, the poor and host of other groups, to attack vigorously the urban waste problems. Thus, the goal of disease prevention and sustenance of healthy environment requires careful attention to the environment which include proper management of solid waste.

RECOMMENDATIONS

In view of the hazards attached to poor solid waste management; the following recommendations are made:

1. Solid waste management should be provided in the yearly budget with a separate head for the purpose of adequate revenue allocation, implementation and monitoring.
2. Enlightened debates, public awareness campaigns through, television and print media, via the chiefs, community leaders, local government and state government and even outright opposition can promote a forum for dialogue and conflict resolution, which can lead to balance policies, and enhance public commitment.
3. Public and private partnership should be highly encouraged to participate in effective solid waste management, to aid disease prevention and sustenance of healthy environment.
4. Bayelsa State government should commit itself to sponsoring more research projects into the reduction of solid waste at source, collection and efficient disposal.
5. There should be comprehensive environmental legislation that relates to environmental sanitation offences. The cases should be tried in environmental courts.
6. There should be adequate and proper town planning for effective solid waste management for example, there is need to provide good access roads, which should be properly linked to one another, and good drainage systems to ease the evacuation of solid waste from all the nooks and crannies of the state.
7. Bayelsa State Government should step-up its commitment to waste management by adopting an integrated waste management approach in the communities. through the provision of adequate waste management infrastructures, education of the masses on the dangers of indiscriminate waste disposal and the practice of waste reduction, reuse and recycle methods of waste management.
8. The central dump site should be in an isolated area, well fenced to avoid nuisance to passersby and curtail the attraction of micro- organisms feasting on the debris
9. Efforts should be geared towards the use of scientific techniques to develop appropriate technologies for dealing with solid waste management, such as encouraging the emergence and development of industrial ecology where wastes from one activity are impute of raw material for another activity.
10. All primary, secondary and tertiary schools curricula should inculcate detailed topics on environmental health education such as solid waste management.

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