Disposal of Solid Waste and Environmental Hazard Control in Ado-Ekiti, Ekiti State for Sustainable Nigeria

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Abstract **:-The more waste we generate ,the more we have to dispose of .The disposal of solid waste in the world is a problem that continues to grow with growth of population .This research work therefore has the main objectives of looking into how household waste generated are disposed in Ado-Ekiti and the method used to achieve the disposal. For this purpose some areas were randomly selected across the city of Ado –Ekiti .Data was then collected from three houses in each area. These data were analyzed to determine the value of solid waste generated per capita per day. The projected volume and the complexity of the solid waste generating for the next 20years was also determined by using the city population with amount of solid waste generated. Field survey indicated that the amount of solid waste generated have increased and will continue to increase in the foreseeable future and there has been a noticeable management measures in sanitary landfill system of disposal for the disposal of waste generated presently and for the future. Increase in the quantity of solid waste is due to overpopulation, affluence and technological advancement. The research therefore recommends that: sanitary landfill is the best method of waste disposal as far as Ado-Ekiti is concern; there should be educational programme and campaign to the people in order to give the people the enlightenment on the need to keep their environment clean by making use of the waste storage containers and their co-operation with collection crews.**

Keywords: **Waste, Hazards, landfill, disposal, collection, Transportation**

I. INTRODUCTION

The disposal of solid waste in the world is a problem that continues to grow with development of industrialized nations and the growth of population. Since the beginning of time people needed to find a way of disposing of their trash .According to Luke Bassis, in 18th century in England and France, carters were paid by individuals to carry trash and discard it on the outskirts of town. Disposal in open pits became routine .Also, in Nigeria, the earliest solid waste method was dumping on ground and the burning in place or letting the elements gradually decompose (if biodegradable). In Nigeria today, collection ,transportation and disposal of solid waste have become the major problem to be given special attention to and the course of these problems to be given special attention to and the course of these problems is not far-fetched .The discovery of crude oil and other minerals in 1960 had got a tremendous impact on the volume of industrial and commercial activities .Heaps of solid wastes are seen in streets ,backyards , market places and several open places .The huge volume of wastes generated as a result of the fact mentioned has becomes so difficult to approach as far as the issue of collection, transportation and disposal is concerned.

Ado- Ekiti being the case study of this research is a center places for all commercial, economics, social and industrial activities. Therefore, the provision of good environmental system and adequate solid waste disposal network should be designed and put in place. The satisfactory disposal of solid waste requires highly integrated and professional operated system includes three processes: collection, transportation and disposal.

In this research, effort was made to access the volume of solid wastes generated in Ado-Ekiti. The study was aim to provide an explanatory frame work for these volumes and lastly provide adequate and modern techniques that can be used in collection ,transportation and disposal of solid waste in our environment.

Aim and Objectives of the Research

The aims and objectives of this research is to analyze the type of solid waste generated, the sources, the distribution, the generating pattern, how and where the solid waste is being generated as well as to investigate the various factors responsible for solid waste generation in different locations or zones in Ado – Ekiti and suggest possible ways to control (collection, transportation disposal) of the solid waste.

Study Area

Ado- Ekiti, the capital city of Ekiti state is geographically located in the south west of Nigeria and it is predominantly of rainforest vegetation.There are two major climate conditions in this region; they are wet and dry seasons. Wet seasons are between Aprils to October while dry season ranges from November to March. The annual rainfall is 135mm.The population of Ado-Ekiti according 2006 census is

306.621.The inhabitants of Ado-Ekiti are mainly Yoruba and Non-Yoruba race. Ado-Ekiti can be grouped into major parts: Ojumose, Ajilosun, Okesa, Irona, Odo-Ado and Okela the old part of Ado-Ekiti being inhabited by indigenes of the town and also on the other hand is the new part of Ado being inhabited by the immigrants who are civil servants and business personnel. The areas are Basiri , Adebayo , Adehun and Ajabamidele.

II. METHODLOGY

Collection and Data analysis

Three operations were carried out in order to obtain proper and adequate method of solid waste disposal in Ado-Ekiti. The operations includes: collection, Transportation and Disposal solid wastes. The starting point is the collection of exiting data about waste collection, after which collection of data and its analysis follows and then correcting it with the current status of the solid waste management in Ado-Ekiti.

The Field survey magnitude of the land use and the waste generation potential of different land use. For proper operations, the statistics data of the solid waste collected and the projection of solid waste generating capabilities by different urban land use types for towns up to data was attempted.

In order to obtain an accurate analysis results and to cope with the existing geographical spread of the town, Ado Ekiti was sectioned into different zones as follows: Basiri-Olorunsogo Area, Oja Oba road, Dalimore, Igirigiri Area, Ekute, Omisanjana and Moferere.

Methods of Operations

1. Collection of information concerning the composition of waste generated as well as the factors influencing the amounts
2. To obtain the information from both the authorized and unauthorized waste depots in chosen areas. The information includes process of direct observation, accessibility of dump site as well as frequency and method of their clearance.
3. Lastly, the confirmation of the various data collected from the authority responsible for solid waste management in Ekiti-state.

An average of three households were randomly selected for sampling in each zone making a total of twenty on households altogether for the operation. A waste storage sac was made available to each household for storing their waste in readiness for the visit of the survey. On the day of visit the waste found in sack was weighed and recorded. The waste was then sorted out into components namely biodegradable components and Non-Biodegradable components. The weight of the biodegradable parts was taken and recorded as well as the Non-biodegradable parts.

The non-biodegradable components are some that are re-useable when sorted out while biodegradable components are some wastes which though cannot be recycled but can be used as natural fertilizer if allowed to decompose in a safe manner (that is in such a way that its decomposition would not bring about environmental hazards)

Table 1.0 Average Refuse Yield Data

Zone 1Basiri (Olorunsogo)Area	House A occupants = 6	House B occupants =5	House C occupants = 4	Average (kg)
Weight of refuse /week (kg)	12.40	8.50	5.20	
Average weight/occupant/week (kg)	$\frac{12.4}{6} = 2.07$	$\frac{8.5}{5} = 1.70$	$\frac{5.2}{4} = 1.30$	
Average weight /person/day (kg)	$\frac{2.07}{7} = 0.30$	$\frac{1.70}{7} = 0.24$	$\frac{1.30}{7} = 0.19$	
Average weight/person/day in zone (kg)	0.30	0.24	0.19	$\frac{0.73}{3} = 0.24$
Weight of biodegradable/week(kg)	7.10	3.20	3.00	
Average weight of biodegradable refuse/person/day (kg)	$\frac{7.10}{6x7} = 0.17$	$\frac{3.20}{5x7} = 0.08$	$\frac{3.00}{4x7} = 0.11$	
Average weight /person/day in zone of biodegradable (kg)	0.17	0.08	0.07	$\frac{0.37}{3} = 0.12$
Weight of Non-biodegradable /week (kg)	5.30	5.30	2.20	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{5.30}{6x7} = 0.13$	$\frac{5.30}{5x7} = 0.15$	$\frac{2.20}{4x7} = 0.08$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.13	0.15	0.08	$\frac{0.36}{3} = 0.12$

Table 2.0 Average Refuse Yield Data

Zone 2 (Oja Oba)Area	House A occupants = 5	House B occupants = 8	House C occupants = 10	Average (kg)
Weight of refuse /week (kg)	13.00	22.40	34.00	
Average weight/occupant/week (kg)	$\frac{13.00}{5}$ = 2.60	$\frac{22.40}{8}$ = 2.80	$\frac{34.00}{10}$= 3.40	
Average weight /person/day (kg)	$\frac{2.60}{7}$ = 0.37	$\frac{2.80}{7}$ = 0.40	$\frac{3.40}{7}$ = 0.49	
Average weight/person/day in zone (kg)	0.37	0.40	0.49	$\frac{1.26}{3}$ = 0.42
Weight of biodegradable/week(kg)	8.51	16.32	22.50	
Average weight of biodegradable refuse/person/day (kg)	$\frac{8.51}{5x7}$ = 0.24	$\frac{16.3}{8x7}$ =0.29	$\frac{22.50}{10x7}$= 0.32	
Average weight /person/day in zone of biodegradable (kg)	0.24	0.29	0.32	$\frac{0.85}{3} = 0.28$
Weight of Non-biodegradable /week (kg)	4.49	6.10	11.50	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{4.49}{5x7} = 0.13$	$\frac{6.10}{8x7} = 0.11$	$\frac{11.50}{10x7} = 0.16$	
Average weight of Non-biodegradable/person/day	0.13	0.11	0.16	$\frac{0.4}{3} = 0.13$

Table 3.0 Average Refuse Yield Data

Zone 3 (Dalimore)Area	House A occupants = 10	House B occupants = 8	House C occupants = 6	Average (kg)
Weight of refuse /week (kg)	20.00	12.40	9.40	
Average weight/occupant/week (kg)	$\frac{20.00}{10}$ = 2.00	$\frac{12.40}{8}$ = 1.55	$\frac{9.40}{6}$= 1.57	
Average weight /person/day (kg)	$\frac{2.00}{7}$ = 0.29	$\frac{1.55}{7}$ = 0.22	$\frac{1.57}{7}$ = 0.22	
Average weight/person/day in zone (kg)	0.29	0.22	0.22	$\frac{0.73}{3}$ = 0.24
Weight of biodegradable/week(kg)	11.90	7.30	4.30	
Average weight of biodegradable refuse/person/day (kg)	$\frac{11.90}{10x7}$ = 0.17	$\frac{7.30}{8x7}$ =0.13	$\frac{4.30}{6x7}$= 0.10	
Average weight /person/day in zone of biodegradable (kg)	0.17	0.13	0.10	$\frac{0.40}{3} = 0.13$
Weight of Non-biodegradable /week (kg)	8.10	5.10	5.10	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{8.10}{10x7} = 0.12$	$\frac{5.10}{8x7} = 0.09$	$\frac{5.10}{6x7} = 0.12$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.12	0.09	0.12	$\frac{0.32}{3} = 0.11$

Table 4.0 Average Refuse Yield Data

Zone 4 (Igirigiri)Area	House A occupants = 8	House B occupants = 5	House C occupants = 4	Average (kg)
Weight of refuse /week (kg)	17.40	6.00	5.40	
Average weight/occupant/week (kg)	$\frac{17.40}{8}$ = 2.18	$\frac{6.00}{5}$ = 1.20	$\frac{5.40}{4}$= 1.35	
Average weight /person/day (kg)	$\frac{2.18}{7}$ = 0.31	$\frac{1.2}{7}$ = 0.17	$\frac{1.35}{7}$ = 0.19	
Average weight/person/day in zone (kg)	0.31	0.17	0.19	$\frac{0.67}{3}$ = 0.22
Weight of biodegradable/week(kg)	9.11	4.10	3.00	
Average weight of biodegradable refuse/person/day (kg)	$\frac{9.11}{8x7}$ = 0.16	$\frac{4.10}{5x7}$ =0.12	$\frac{3.00}{4x7}$= 0.11	
Average weight /person/day in zone of biodegradable (kg)	0.16	0.12	0.11	$\frac{0.39}{3} = 0.13$
Weight of Non-biodegradable /week (kg)	8.29	1.90	2.40	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{8.29}{8x7} = 0.14$	$\frac{1.90}{5x7} = 0.05$	$\frac{2.40}{4x7} = 0.09$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.14	0.05	0.09	$\frac{0.28}{3} = 0.09$

Table 5.0 Average Refuse Yield Data

Zone 5 (Ekute)Area	House A occupants = 8	House B occupants = 9	House C occupants = 6	Average (kg)
Weight of refuse /week (kg)	10.80	11.60	5.20	
Average weight/occupant/week (kg)	$\frac{10.80}{8} = 1.35$	$\frac{11.60}{9} = 1.29$	$\frac{5.20}{6} = 0.12$	
Average weight /person/day (kg)	$\frac{1.35}{7} = 0.19$	$\frac{1.29}{7} = 0.18$	$\frac{0.87}{7} = 0.12$	
Average weight/person/day in zone (kg)	0.19	0.18	0.12	$\frac{0.49}{3} = 0.16$
Weight of biodegradable/week(kg)	6.70	8.22	2.10	
Average weight of biodegradable refuse/person/day (kg)	$\frac{6.70}{8x7} = 0.12$	$\frac{8.22}{9x7} = 0.13$	$\frac{2.10}{6x7} = 0.05$	
Average weight /person/day in zone of biodegradable (kg)	0.12	0.13	0.05	$\frac{0.30}{3} = 0.10$
Weight of Non-biodegradable /week (kg)	4.10	3.38	3.10	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{4.10}{8x7} = 0.07$	$\frac{3.38}{9x7} = 0.05$	$\frac{3.10}{6x7} = 0.07$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.07	0.05	0.07	$\frac{0.19}{3} = 0.06$

Table 6.0 Average Refuse Yield Data

Zone 6(Omisanjana)Area	House A occupants = 8	House B occupants = 4	House C occupants = 7	Average (kg)
Weight of refuse /week (kg)	7.60	4.80	6.10	
Average weight/occupant/week (kg)	$\frac{7.60}{8} = 0.95$	$\frac{4.80}{4} = 1.20$	$\frac{6.10}{7} = 0.87$	
Average weight /person/day (kg)	$\frac{0.95}{7} = 0.14$	$\frac{1.20}{7} = 0.17$	$\frac{0.87}{7} = 0.12$	
Average weight/person/day in zone (kg)	0.14	0.17	0.12	$\frac{0.44}{3} = 0.15$
Weight of biodegradable/week(kg)	3.81	2.00	1.22	
Average weight of biodegradable refuse/person/day (kg)	$\frac{3.81}{8x7} = 0.07$	$\frac{2.00}{4x7} = 0.07$	$\frac{1.22}{7x7} = 0.03$	
Average weight /person/day in zone of biodegradable (kg)	0.07	0.07	0.03	$\frac{0.17}{3} = 0.06$
Weight of Non-biodegradable /week (kg)	3.79	3.79	4.38	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{3.79}{8x7} = 0.07$	$\frac{3.79}{4x7} = 0.14$	$\frac{4.88}{7x7} = 0.10$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.07	0.14	0.10	$\frac{0.31}{3} = 0.10$

Table 7.0 Average Refuse Yield Data

Zone 7(Mofere)Area	House A occupants = 10	House B occupants = 6	House C occupants = 4	Average (kg)
Weight of refuse /week (kg)	16.20	14.80	8.50	
Average weight/occupant/week (kg)	$\frac{16.20}{10} = 1.62$	$\frac{14.80}{6} = 2.40$	$\frac{8.50}{4} = 2.13$	
Average weight /person/day (kg)	$\frac{1.62}{7} = 0.23$	$\frac{2.47}{6} = 0.35$	$\frac{2.13}{7} = 0.30$	
Average weight/person/day in zone (kg)	0.23	0.35	0.30	$\frac{0.8}{3} = 0.29$
Weight of biodegradable/week(kg)	4.55	6.80	4.55	
Average weight of biodegradable refuse/person/day (kg)	$\frac{4.55}{10x7} = 0.07$	$\frac{6.80}{6x7} = 0.16$	$\frac{4.55}{4x7} = 0.16$	
Average weight /person/day in zone of biodegradable (kg)	0.07	0.16	0.16	$\frac{0.39}{3} = 0.13$
Weight of Non-biodegradable /week (kg)	11.65	8.00	4.00	
Average weight of Non-biodegradable refuse/person/day (kg)	$\frac{11.65}{10x7} = 0.17$	$\frac{8.00}{6x7} = 0.19$	$\frac{4.00}{4x7} = 0.14$	
Average weight of Non-biodegradable/person/day in zone (kg)	0.17	0.19	0.14	$\frac{0.5}{3} = 0.17$

Table 8.0 Average weight of refuse generated per person per day in Ado-Ekiti

Zone	Average Wt./person/day (kg)	Average Wt. of Biodegradable/person/day (kg)	Average Wt. of Non-Biodegradable/person/day (kg)
1	0.24	0.12	0.12
2	0.42	0.28	0.13
3	0.24	0.13	0.11
4	0.22	0.13	0.09
5	0.16	0.10	0.06
6	0.15	0.06	0.10
7	0.29	0.13	0.17
Total	**1.72**	**0.95**	**0.77**

Summary : Average weight /per/day =1.72/7 = 0.25kg out of which 0.14kg is the weight of biodegradable waste and 0.11kg is the weight of non-biodegradable waste .Therefore ,the average weight of biodegradable waste person per day is 0.14kg to be used for the landfill design.

Total load estimate

The load estimate per capita per day in Ado-Ekiti according to the result of the test conducted is 0.25kg.Ado –Ekiti has a population of about 306,621(2006 census).And her in 1991 (fifteen years earlier) is 156,122(National Bureau of Statistics).Therefore from the year 1991 to 2006 which is years interval, validation was made with the annual growth rate obtained. Therefore, the possible projection of Ado-Ekiti in the next twenty years from year 2011 using the formula below R= $\frac{1}{n}\frac{P_{n-P_o}}{P_o}\ x\ 100$

Where:P_n = population of the current year

P_o= population of the base year

R=annual rate of growth

n = number of intermediary years (Chesswas. J.D. 1969)

The Compound growth rate can also be computed using this formula given below

$[\ (\frac{P_n}{P_n})\ \frac{1}{n} - 1]$ x 100 = P_n=$P_o(1+\frac{R}{100})^{n}$

In our case, $P_n = 30{,}621, P_0$ = 156,122 n =15years

Therefore R= $[(\frac{308.621}{156.122})^{1/15} - 1]$ x 100 = 4.6479 = 6.6480%

To validate the accuracy of the above formula

$P_{2006} = P_{1991}\ (1+\frac{4.648}{100})^{15}$ =308622

The projected population in twenty years would be

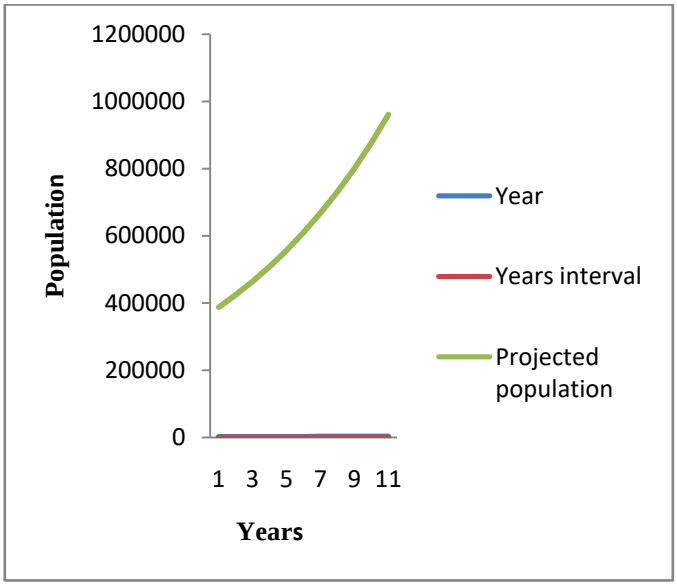
$P_{2011} = P_{1991} = [1+\frac{R}{100}]^{n} = 156.122\ [1+\frac{4.648}{100}]^{20} = 387331.45$

P_{2011} = 387332

Table 9.0 Projected populations from the year 2011 to 2031

Year	Years interval	Projected population
2011	0	387332
2013	2	424176
2015	4	464523
2017	6	508709
2019	8	557098
2021	10	610089
2023	12	668121
2025	14	731672
2027	16	801269
2029	18	877486
2031	20	960953

The magnitude of the projected population of Ado –Ekiti was used to project weight of solid waste generated for the next twenty years. Since there are 365days in a year ,the weight of solid waste generated in kg per capita per year will be 0.14kg x 365 = 51.1kg/capita/year.



Projected population from year 2011 to 2031

Factors considered in the Design and operation of Landfill

- The selection of a site for a proposed landfill was made with social, political and economic factors. Proper consideration of these facts aids in the avoidance of possible economic and legal difficulties and helps to provide adequate social considerations.
- Planning of land fill size was made based on community needs and growth patterns for a 20 years period.

- With already existed landfill sites in Ado Ekiti one located along Ikere road and Iworoko road another one could be sited in the state capital in order expedite Ekiti state government action to control environmental hazards.
- The availability of more than 100 acres along Afao road which has the capacity to handle several waste coupled with the terrain makes the areas suitable for landfill operation. Other factors in the proposed landfill includes: accessibility of road way to the area and because of large area, the landfill site will not bring about contamination of ground water; to create environmentally friendly landfills the site along Afao road should be engineered to recover methane gas that will be generated during decomposition in the landfill.
- Solid waste should be compacted to conserved waste disposal
- Compressed layers or refuse should be less than two feet (2ft) thick thus allowing a greater overall depth by placing these cells one on top of the other.
- Recommended height of these compressed cells is about (10ft/3m). Although some large operations have used up to (30ft/9m)

Design Analysis

Design period for the sanitary landfill is 20years (from2011-2031).Population for year 2011 is 387332.for the 20yearsof the design, population is 960953 for 2031.weight of waste generated in 2011 will be multiplying factor x 387332 whereby the multiplying factors is 0.14x365=51.1kg

Therefore = 51.1x387332 = 19792665.2kg or 19792.67Tons.

The expected waste in the year 2031 will be 51.1 x 960953 = 49104698.30kg = 49104.70Tons

To determine the capita generation per annum, any of the values estimated above could be taken for a year 2011 = $\frac{weig\,ht}{popul\,ation} = \frac{19792665.2}{387332} = 51.1\text{kg}$.

Table 10.0 Weight of the waste generated /capita/year

Year	Interval	Projected population
2011	1	387322
2012	1	405336
2013	1	424176
2014	1	443891
2015	1	464523
2016	1	486114
2017	1	508709
2018	1	532354
2019	1	557098
2020	1	582991
2021	1	610089
2022	1	638446
2023	1	668121
2024	1	699175
2025	1	731672
2026	1	765681
2027	1	801269
2028	1	838512
2029	1	877486
2030	1	918272
2031	1	960953

Year 2011 weight = 51.1 x 387332 = 19792.67 Tons

Year 2012 weight = 51.1 x 405336 = 20712.67 Tons

Year 2013 weight = 51.1 x 424176 = 21675.39Tons

Year 2014 weight = 51.1 x 443891 = 22682.83 Tons

Year 2015 weight = 51.1 x 464523 = 23737.13Tons

Year 2016 weight = 51.1 x 486114 = 24840.43Tons

Year 2017 weight = 51.1 x 508709 = 25995.03 Tons

Year 2018 weight = 51.1 x 532354 = 27203.29Tons

Year 2019 weight = 51.1 x 557098 = 28467.71Tons

Year 2020 weight = 51.1 x 582991 = 29790.84Tons

Year 2021 weight = 51.1 x 610089 = 31175.55Tons

Year 2022 weight = 51.1 x 638446 = 32624.59Tons

Year 2023 weight = 51.1 x 668121 = 34140.98Tons

Year 2024 weight = 51.1 x 699175 = 35727.84Tons

Year 2025 weight =51.1 x 731672 = 37388.44 Tons

Year 2026 weight = 51.1 x 765681 = 39126.30Tons

Year 2027 weight = 51.1 x 801269 = 40944.85Tons

Year 2028weight = 51.1 x 838512 = 42847.96Tons

Year 2029 weight = 51.1 x 877486 = 44839.54Tons

Year 2030 weight = 51.1 x 9182272 = 46923.70Tons

Year 2031 weight = 51.1 x 960953 = 49104.70Tons

All these values added together will be 679742.44Tons .This is the total weight expected to be generated till the year 2031

III. CONCLUSION

The project had provided a fair knowledge and pictures about solid waste is, types of waste generation per capita per day ,the environmental hazard inherent in untreated solid wastes,

composition of solid waste and disposal of wastes. Field survey indicated that amount of solid waste generated have increased and will continue to increase in the feasible future and there has been a noticeable management measures in sanitary landfill system of disposal for the disposal of waste generated presently and for the future. Due to escalation in the rate of urbanization of Ado-Ekiti, serious solid waste pollution is very real. More so, the field survey shows the attitude of people towards solid waste storage and disposal which is very poor not take into consideration the health hazard of improper storage. The increase in the quantity of solid waste is due to overpopulation, affluence and technological advancement .The problem of solid waste collection, transportation and disposal should be given more emphasis on the need for the re-evaluation for delivering modern services efficiency to urban community and it is the believe that the waste management authority has an important creative role to play in the re-evaluation exercise. From the research it shows that getting rid of solid waste generated daily in Ado-Ekiti would not be an easy task and how to solve the problem of waste collection, transportation and disposal.

IV. RECOMMENDATIONS

Despite the enormity task of solving problem of solid waste generated in the city of Ado-Ekiti due to the yearly increase in population, the following recommendations would help to reduce the problem of collection, transportation and disposal considerably if strictly adhered to.

- Storage containers should be provided for every household by the local government, at subsidized rate, for storage of solid waste. This will make collection solid waste easier for the collection crew using any of the available methods and transport it for disposal
- State and local government should set up functional task force in monitoring the use of the storage tanks or containers, the disposal of solid waste and to monitor and supervise the disposal operation.
- Sanitary landfill is the best method of solid waste disposal as far as Ado-Ekiti where the project research was conducted is concern.
- National war against indiscipline should be encouraged Also, the federal government should embed it in the budget where by certain amount of money is set aside for federal and state environmental potential Agency (FEPA and SEPA) on the management of solid waste at different states level while local government council in charge of solid waste should not be left out.
- Haphazard dumping of waste or refuse in an authorized places should be restricted. Anybody caught in the act of violating the law should be made to face the wrath of law

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