

Factors Influencing Solid Waste Management in Nansana Municipal Division Council- Nansana Municipality, Wakiso District-Uganda

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Abstract

Background: Poor solid waste management is still a great challenge being faced by urban authorities in Uganda including Nansana Municipality where in particular there is still a challenge of indiscriminate and open dumping of solid waste along the streets that has led to other related health challenges currently affecting the Municipality.

Purpose: Assessing factors influencing solid waste management in Nansana Municipal division in order to provide stakeholders with information that would be used to design appropriate interventions towards proper solid waste management.

Methodology: A descriptive cross-sectional study design was used to collect both qualitative and quantitative data. Stratified cluster sampling procedure was used to obtain the households of respondents while the Purposive sampling was used to obtain the key informants.

Results

Majority of the respondents, 55.6 % (151/272) had moderate knowledge about solid waste, 29.6% (80/272) of the respondents had high knowledge on solid waste management. While 14.8% (40/272) had low knowledge on proper solid waste management.

73.5% (200/272) of the waste is generated in form of food remains while solid waste in form of plastics and raw vegetables compose 52.2% (142/272). 84.2% (229/272) store waste before disposing it off but only 40.2% (92/229) of them store it in refuse bins. Majority 82.2% (222/272) of the respondents were disposing off waste at the road side. Majority of the respondents, 91.5% (249/272) of the respondents were not engaged in segregating solid waste.

Keywords: solid waste, segregation, refuse bins, households.

Introduction

Management of solid waste is still a challenge being faced by city governments around the globe. Disposal of solid waste economically without degrading the environment is a problem both in developed and developing countries. It is estimated that municipalities generate 40% of the world's municipal solid waste and the authorities can only collect 20 to 25% of the solid waste generated and 75-80% of the solid waste is disposed of in open dumps (UNEP, 2000).

Poor management of solid waste can create several environmental hazards. For example, value of land within the area depreciates because the air and water generally get polluted, Health problems such as cholera, bad smells and malaria may escalate (OJ. Ojok, M.K. Koech et

al 2012 and Kinobe et al 2015). This is because poorly disposed solid waste acts as bleeding sites for vectors like mosquitoes and house flies that spread diseases hence compromising people's health. In the same study OJok reported that leachates from landfills also pollutes both surface and ground water because the wastewater treatment are insufficient and some landfills are not adequately protected to prevent leachate percolation.

Furthermore in Uganda and Nansana Municipal council Division in particular, there has been a high population and economic growth with increased industrialization which have subsequently led to high generation of solid waste and the unfortunate part of it is that the increased generated solid waste has not been accompanied by an equivalent increase in the

capacity for managing those wastes and the people have resorted to indiscriminate dumping of solid waste along the streets and in swamps.

More so the constitution of Uganda (1995) also places a lot of emphasis on building of health nation and the government is committed to fulfilling this goal so that all Ugandans can attain good health, social and economic wellbeing. So, as Uganda strives to meet the Sustainable Development Goals, there is need to develop strategies for municipal solid waste management that will address both informal and formal sectors challenges. These strategies include the following; minimization of waste, promotion of waste recycling and re-use, compositing, increasing service coverage and ensuring environmentally sound disposal.

Therefore, this study will help to identify the challenges faced in promoting good solid waste management and provide strategies that can be used by the local authority in Nansana municipal Council to address the problem of poor solid waste management in Nansana Municipal Division.

Methods

Study setting and context

The study took place in Nansana Municipal Council Division which is one of the divisions of Nansana Municipality in Wakiso district - Uganda, located at 0° 21' 50.0" N, 32° 31' 43.0" E, and it is approximately 8.1km by road, north-west of Kampala capital city along Kampala-Hoima road. it stands at 32.528611 longitudes and latitude 0.363889 North of Equator (Nansana Municipal Development Plan (NMDP) 2014/15-2019/20).

Nansana Municipal Council Division has six zones which include Nansana west, Nansana East, Ochieng, Nabweru north and Nabweru south and it also hosts the municipality headquarters and has most of the commercial business buildings of Nansana Municipal town with three busy markets and small-scale industries like welding.

Nansana Municipal Council Division is also the most populated division of the municipality with a total population of 27768 people (12420 male and 15348 female) with 6898 total number of households of which 29.3% are female headed according to the NMDP statistics 2014/15-2019/20, and (UBOS 2014).

Study design

A descriptive cross-sectional study was used to collect both quantitative and qualitative data.

The sample size was obtained using Leslie and Kesh formula;

$$N = \frac{Z^2 PQ}{d^2}$$

Where N is the sample size needed for the study

Z is the 95% confidence interval (Z value is 1.96)

P is the proportion of households which is 0.5

Q=1-0.5=0.5

D is the marginal error thus 0.06

Therefore; $N = \frac{1.96^2 * 0.5 * 0.5}{0.06^2}$

0.06²

N=267 households

2% of N value; $\frac{2 * 267}{100} = 5$ was added to the calculated sample size to cater for any missing results, therefore the overall sample size for this study was 272.

15 Key informants were involved in the study and these included three health inspectors, 4 enforcement officers 3 market leaders and 5 garbage collectors

A Stratified cluster sampling procedure together with simple random technique was used to obtain the domestic households of respondents while systematic sampling was also employed in getting the commercial households along the Main road this was easy since most of the houses are in linear arrangement. Finally, the Purposive sampling was used to obtain the key informants.

The number of households were divided into small groups called strata whereby the first strata was for Restaurants, the second strata for Commercial Business shops, the third strata for the Residential domestic households while the fourth strata was for the Market Stalls. An equal number of respondents were picked from each strata. 272 were divided into four strata which gave 68 respondents from each strata. The 68 elements were selected through a systematic sampling procedure at a given interval because the Commercial houses in Nansana Division are built in a linear along the road. But since the households in the Residential Domestic strata, are not in a linear arrangement, for that case a simple random sampling procedure were used to

obtain the 68 households. The researcher wrote all the names of the households on a paper, folded and mixed them in one basket from where he picked randomly one by one without replacement until the required number was obtained.

In every household that was selected one person who falls in the age bracket of 18-70 years was interviewed and that was a person who was found present at the time of interview as long as he/ she resided or operated in that household for more than three months.

Study units

The study units were the households of Nansana Municipal Council Division with males and females between 18 and 70 years of age who have stayed in the place for more than three months. The study involved 272 households in the six zones of Nansana Division that is households in Nansana East, Nansana West, Ochienge, Nabweru South and Nabweru North. 15 key informants who included Health inspectors, the enforcement team, garbage collectors and Market leaders working in Nansana Municipal Council Division.

Data collection and analysis

Quantitative data from household respondents was collected using structured questionnaires. The structured questionnaires helped to collect data on social-demographic characteristics, storage, transportation, disposal of solid waste and handling. Data collected from households involved interviewing respondents. Also, an observation check list was also used to confirm the responses from the respondents. Two research assistants were trained to help in data collection.

Qualitative data from the key informants was collected using recording tapes and phone recordings. The recording was then typed analyzed manually and presented according to the themes and conceptual frame work.

The collected quantitative data was entered and coded in the computer and analyzed by EPI info software, version 3.5.1.0. Charts, tables, and graphs were obtained using the program. Qualitative data was analyzed manually.

For associations between variables, chi-square test was used. The associations were considered statistically significant when P (probability) ≤ 0.05 in the tests.

Four knowledge questions were used to assess each of the respondents' knowledge about solid waste management. The considered questions were about knowing what solid waste management is, health education, knowledge about other uses of solid waste management, and knowledge about the dangers of solid waste management (respondents who mentioned all the provided correct options about dangers of solid waste management were the only ones considered knowledgeable for this question). Each respondent who answered yes for each of the four variables was awarded one score, therefore the maximum number of scores was 4. For one to be considered as having high knowledge about solid waste management they should have obtained a score of (3-4), and one with moderate knowledge should have obtained a score of 2 and the respondent with a score of less than 2 was regarded to be having low understanding of solid waste management.

Threats to validity and reliability were minimized through training of research assistants. There was training of research assistants who were knowledgeable about solid waste management practices. There was pre-testing of study instruments and translation of questionnaires into the local language. At the end of the day's work there was a debriefing meeting to ensure that data was collected as planned.

Results

Level of respondents' knowledge about solid waste management

Majority of the respondents, 55.6 % (151/272) had moderate knowledge about solid waste, 29.6% (80/272) of the respondents had high knowledge on solid waste management. While 14.8% (40/272) had low knowledge on proper solid waste management.

Table 1. Summarized level of respondents' knowledge about solid waste management

| Level of knowledge on SWM | Score | Frequency (%) |
|---------------------------|-------|---------------|
| High | 3-4 | 29.6 |
| Moderate | 2 | 55.6 |
| Low | 1 | 14.8 |

Knowledge about solid waste management

Majority of the respondents, 62.4% (169/272) mentioned that they knew the meaning of solid waste management and more than half of them who had answered that they knew what solid waste management was, 75.1% of them (127/169) learnt about solid waste management from Home. The study also showed that though 169 respondents knew what solid waste management, 70.4% of the 169 respondents (119/169) had not received enough health education on proper solid waste management. Relatedly, majority 80% (12/15) of the key

informants mentioned that they were not well equipped with skills in solid waste management. For the few, 30.0% (50/169) who had been health educated, it was mostly done by the municipal council, 90.0% (45/50) this in line with the response from all the three health inspectors who provided key informant data who reported that they engaged in sensitizing the community about solid waste management during their filed inspection while meeting people from their homes. Also, Majority of the respondents, 76.8% (209/272) knew that solid waste can have other uses. See details in table 2 below.

Table 2. Knowledge of respondents about solid waste management

| Variable | Frequency (n=272) | Percentage (%) |
|---|-------------------|----------------|
| Know what solid waste management is | | |
| Yes | 169 | 62.4 |
| No | 103 | 37.8 |
| Source of information about what solid waste management is | (n=169) | |
| Radio | 11 | 6.5 |
| Television | 12 | 7.1 |
| Home | 127 | 75.1 |
| School | 19 | 11.2 |
| Health education session on proper solid waste handling | (n=169) | |
| Yes | 50 | 30.0 |
| No | 119 | 70.4 |
| Organizer of health education session on proper solid waste management | (n=50) | |
| Municipal council | 45 | 90.0 |
| NGO | 5 | 10.0 |
| Knows that solid waste has other uses | (n=272) | |
| Yes | 209 | 76.8 |
| No | 63 | 23.2 |
| Uses of solid waste | (n=209) | |
| Animal feed | 124 | 59.3 |
| Manure | 164 | 78.5 |
| Other | 61 | 29.1 |
| Dangers of improper solid waste management (Multiple responses) | (n=272) | |
| Bad smell | 228 | 83.8 |
| Accidents | 50 | 18.4 |
| Unsanitary environment | 93 | 34.2 |
| Breeding grounds for vectors | 91 | 33.4 |
| Blockage of drainage | 90 | 33.1 |
| Diseases | 214 | 78.7 |

Methods of solid waste management

Majority of the participants generate solid waste in form of food remains, 73.5% (200/272) and more than half of them, 52.2% (142/272) generate solid waste in form plastics and raw vegetable matter. Majority of the respondents, 84.2% (229/272) store waste before disposing it off but few of them, 40.2% (92/229) keep it in refuse bins. Majority 82.2% (222/272) of the respondents were disposing off waste at the road side. Majority, 75.4% (205/272) mentioned that it is the responsibility of the local council to collect and dispose of waste properly. Dumping/collection sites for solid waste were located within 0-5 meters for most of the respondents, 88.9% (242/272). More than half, 60% (9/15) of the key informants reported that the final disposal of solid waste was done at a dumping site and all of them mentioned one that

is called Kiteezi. Majority of the respondents, 91.5% (249/272) were not engaged in segregating solid waste and this was because of some of the following reasons, lack of containers for segregation, 42.6% (106/249); very tedious to separate, 37.8% (94/249). Additionally, majority, 85.3% (232/272) of the respondents were not re-using solid waste.

Knowledge factors

A significant relationship was observed between knowing what solid waste management is and re-use of solid waste ($P=0.05$). There was no significant association between sorting of solid waste and the following knowledge indicators: knowing what solid waste management is, having been health educated about proper solid waste management and knowing that solid waste has other uses.

Table 3. Methods used in solid waste management

| Variable | Frequency (n=272) | Percentage (%) |
|--|-------------------|----------------|
| Types of waste generated (Multiple responses) | | |
| Food remains | 200 | 73.5 |
| Plastics | 142 | 52.2 |
| Metals | 5 | 1.8 |
| Raw vegetable matter | 142 | 52.2 |
| Store waste before disposing of | | |
| Yes | 229 | 84.2 |
| No | 43 | 15.8 |
| Type of containers used (n=229) | | |
| Refuse bins | 36 | 15.7 |
| Polythene bags | 92 | 40.2 |
| Sacks | 101 | 44.1 |
| Where waste is disposed of after collection (n=272) | | |
| Refuse skip | 8 | 2.9 |
| Burry it | 2 | 0.7 |
| Road side | 222 | 82.2 |
| Dumping site | 2 | 0.7 |
| Burn it | 38 | 14.0 |
| Responsible for collection and disposal of waste (n=272) | | |
| Local council | 205 | 75.4 |
| Employee | 1 | 0.4 |
| Private collection | 66 | 24.3 |
| Distance between household and dumping /collection site (n=272) | | |
| Within 0-5 meters | 242 | 88.9 |
| Within 5-10 meters | 27 | 9.9 |
| Above 10 meters | 3 | 1.1 |
| Do you sort solid waste before taking to dumping site (n=272) | | |

| | | |
|-------------------------------------|----------------|------|
| Yes | 23 | 8.5 |
| No | 249 | 91.5 |
| Reason for sorting waste | (n=23) | |
| Recycling | 4 | 17.4 |
| Source of income | 5 | 21.7 |
| Reduce waste | 5 | 21.7 |
| For animal feeds | 13 | 56.5 |
| Reason for not sorting waste | (n=249) | |
| Lack of segregating containers | 106 | 42.6 |
| Very tedious/demanding to separate | 94 | 37.8 |
| Dirty job and time wasting | 24 | 9.6 |
| Not necessary | 25 | 10.0 |
| Reuse waste | (n=272) | |
| Yes | 40 | 14.7 |
| No | 232 | 85.3 |

Table 4. Knowledge factors associated with sorting of solid waste and re-use methods of solid waste management

| Knowledge factors | Sort Solid waste | | | | Re-use solid waste | | | | |
|--|------------------|------------|------|---------|--------------------|------------|------|--------------|------|
| | Yes | No | Chi2 | P Value | Yes | No | Chi2 | P Value | |
| | N (%) | N (%) | | | N (%) | N (%) | | | |
| Know what solid waste management is | | | | | | | | 2.6 | 0.11 |
| Yes | 13 (7.7) | 156 (92.3) | 0.1 | 0.72 | 20 (11.8) | 150 (88.2) | 0.9 | 0.000 | |
| No | 10 (9.8) | 92 (90.2) | | | 19 (18.8) | 82 (81.2) | 1.6 | 0.000 | |
| Health education session on proper solid waste handling | | | | | | | | | |
| Yes | 2 (11.8) | 15 (88.2) | 0.5 | 0.50 | 3 | 14 | 0.8 | 0.37 | |
| No | 11 (7.2) | 142 (92.8) | | | 16 | 137 | | | |
| Knows that solid waste has other uses | | | | | | | | | |
| Yes | 20 (9.6) | 189 (90.4) | 1.2 | 0.28 | 32 | 177 | 0.6 | 0.43 | |
| No | 4 (6.3) | 59 (93.7) | | | 8 | 55 | | | |

Discussion

Lack of knowledge and awareness

Although several studies indicate that creation of awareness on solid waste management is key in ensuring proper management of the waste (Nkwocha & Emeribe, 2008) (Lumbreras Martín and Fernández García, 2014), majority of the participants of this study, 70.4% had not received health education on proper solid waste management

The information of proper solid waste management was not only seen to be limited among the respondents but also among the key informants, especially among the garbage collectors and market leaders where by 80% of the key informants mentioned that they were not well equipped with skills in solid waste management. This could be attributed to lack of adequate man power/ skilled personnel to train the community or reluctance of the municipal

officials to carry out awareness talks, health education and sensitization in the communities and also lack of appropriate training manual/guide on solid waste management periodically. Another reason could be that the waste management activities may have not been allocated enough funding in the Municipal work plan budget thus hindering the proper running of the activities. Therefore, like it was suggested by Al-Khatib et al., 2009, there is need for introduction, promotion and strengthening of strategies that because positive behavior change in solid waste management

This study also shows a significant relationship between knowing what solid waste management is and re-use of solid waste (P=0.05). It indicates that with proper training of the students/pupils at school and regular health education and sensitization within the community can improve on the level of knowledge of individuals on proper solid waste

management and further more lead to positive behavioral change and attitude.

These findings are similar to those of the study conducted in Malaysia on practices, attitude and motives for domestic waste recycling which indicated that, in order to overcome the solid waste crisis, the “conscience of the individual needs to be raised through environmental awareness and education on waste management.” Environmental awareness and knowledge about environmental conservation were found to affect recycling attitude positively but positive attitude may not have resulted in recycling if knowledge about it was poor (Aini et al., 2002),

Therefore it can be argued that individual knowledge on the benefits of good sanitation could greatly increase their efforts to participate in proper solid waste management and the fact the majority of the people had not received enough health education on solid waste management makes it the factor that was still contributing to poor solid waste management. This argument is in line with the findings of Agamuthu and colleagues where they stated that Knowledge about solid waste sources and types as well as information on its composition and rates of production and disposal is essential for the design and operational facets of the functional elements concomitant to solid waste management. Knowledge of the nature of the wastes was found to be crucial for the waste management process since it can help waste managers deal with the different types of wastes in appropriate ways as well as reduce the potential negative impacts attendant to its waste handling and handlers (Agamuthu 2001, Ramachandra 2006, Nadi, Mahmud et al. 2009, Shamshiry, Nadi et al. 2011).

Institutional challenges

The study also aimed to find out the institutional challenge that were leading to poor solid waste management in Nansana Municipal Council Division. The results indicated that it is the mandate of the Municipal council Authority to collect the waste generated in area. 75.4% of the respondent confirmed that it was the responsibility of the municipality and this was also in line with what the three health inspectors mentioned when they all reported that solid waste collection was the responsibility of the local authority. Though the local Authority had

that mandate of being responsible for solid waste management, only 43.8% of the respondents strongly agreed that the municipal council provided sufficient services towards proper solid waste management meaning the services were lacking. Lack of funding, increasing population, lack of personal protective equipment and failure to provide waste containers to the community by municipal council authority was some of the reasons cited that lead to poor waste management.

The above finding were not very different from those of other countries for example in Lagos (Ogwueleka and Engineering 2009) the municipal council has the mandate to collect wastes and payment from households. Due to factors such as lack of institutional arrangement, insufficient financial resources, absence of bylaws and standards, inflexible work schedules, insufficient information on quantity and composition of waste, and inappropriate technology, solid waste management has not been effective. Private collectors using push carts, wheelbarrows and scavengers are employed to manage and dispose of the wastes in areas where the municipal agencies cannot reach thus the need to recognize the informal services providers.

Similarly In Dhakar Bangladesh (Matter, Dietschi et al. 2013) and (Sujauddin, Huda et al. 2008) it was also noted that the municipality collects less than half of the waste produced due to lack of enough funding resources ,high charges for collection, delays in time of collection and Low enforcement procedures.

More so In India (Hazra and Goel 2009) it was found that the collection process is deficient in terms of manpower and vehicle availability. Bin capacity provided is adequate but locations were found to be inappropriate, thus contributing to the inefficiency of the system. There is no treatment provided to the waste and like in Uganda and Nansana Municipal Division in Particular. Solid waste is dumped on open land at after collection. Lack of suitable facilities (equipment and infrastructure) and underestimates of waste generation rates, inadequate management and technical skills, improper bin collection, and route planning are noted to be responsible for poor collection and transportation of municipal solid wastes.

Therefore, it can be urged that Institution factors as those identified above greatly affect

solid waste management and continue to contribute to the existence of this problem in Nansana Municipal Division hence a need for equipping the Municipal authority with enough funding to manage solid waste properly.

Methods used and practiced in solid waste management

It has been reported by different researchers that lack of proper methods of solid waste management contributes to open dumping of wastes and burning which greatly contributes to environmental and health hazard like air pollution and breeding sites for diseases spreading vectors (OJ. Ojok M.K. Koech et al 2012).

This study found out that People were using poor method of managing solid waste in Nansana For example Majority 82.2% of the respondents were disposing off waste at the road side, 14% were burning their waste, 0.7 % were burring it and only 2.9% were disposing off their waste in a skip before being taken for dumping.

This clearly indicates as to why there is a problem of poor solid waste management in Nansana Municipal Division since most of the people were lacking the proper methods of solid waste management. These results are coinciding to those in study conducted in two urban slums of Kikuulu (located in the outskirts of Kampala, the capital city of Uganda) and Kikooza (located in Mukono municipality by where it was found out that open dumping of wastes and burning of waste were the waste disposal methods used in those slum areas and that was because those slums were congested and unplanned, characterized by poor access to social amenities and poor solid waste management practices, and inhabited by people of low socioeconomic status and operating small scale trading businesses (Mukama, 2016).

The study further found out that few people used the most appropriate methods of managing solid waste such as sorting and reuse

Only 8.5% were involved in sorting their waste before disposing it off while 14% would reuse their waste for other uses like animal feed, recycling and source of income. This clearly shows that few people were actually doing the right things of sorting and reusing the solid waste leaving the greatest percentage 77.5% of the people carrying out indiscriminate disposal of unsorted waste on the streets. The reasons

given as to why they were not sorting or re using their waste were lack of segregation containers 42 %, very tedious 37.8 %, dirty job and wasting time 9.6 %, and not necessary were 10 %.

These findings are also similar to those of study that was conducted by Bennagen et al on solid waste segregation and recycling in Metro Manila where it was found that 53% of the people who did not engage in segregation of solid waste, cited a lack of time or a troublesome chore while 36% indicated that it was of no use since garbage collectors dumped all the wastes into the same truck. Some 19% reported storage space as a problem while 20% regarded waste segregation as not important. Only a few households cited cost as a reason for not segregating which is expected since the respondents were middle-income households. (Bennagen, Nepomuceno et al. 2002)

Also in a study (Ajayi, Oyedele et al. 2017) on construction site indicated that contractual provisions for waste minimization, waste segregation, maximization of materials reuse and effective logistic management are underlying factors for onsite waste management practices. In this case waste segregation was shown to be provision of waste skips for different materials and setting up of waste bins at each building zone. Spaces for waste sorting, adequate positioning of waste skips and its proper labeling are important for effective waste collection, segregation, reuse and recycling. This further reinforces the importance of waste segregation as a requisite for effective waste treatment as well as the likelihood of materials reuse and recycling activities. In Indonesia it was found that (Chaerul, Tanaka et al. 2008) to minimize the risk to public health, waste segregation as well as infectious waste treatment prior to disposal, has to be conducted properly by the hospital management.

The study also looked at nature of solid waste generated in NMCD and it found out the commonly collected wastes comprised of mainly food items which are biodegradable since they are household wastes. This is similar to other studies (Sujauddin, Huda et al. 2008) which showed that vegetable/food waste being the largest component (62%) and in Nigeria (Ogwueleka and Engineering 2009) the majority of substances composing municipal solid waste include vegetable matter, plastics metals paper,

etc. In Metro manila(Bennagen, Nepomuceno et al. 2002) it was found that food wastes comprised 28%, yard wastes 12% and mixed wastes 60%.

Conclusion

The study found out that there was poor management of solid waste in Nansana municipal division and factors such as low knowledge on proper methods of solid waste management, failure of provision for facilities for separation of degradable and non-degradable solid wastes, vehicle breakdown, delays in collection by private collectors, inaccessible roads, inadequate funding, lack of designated dumping sites, high fee charges and failure of people to pay for collection of wastes were the major factors contributing the problem of poor solid waste management

Recommendations

1. Campaigns for waste separation and reuse should be focused in the peri-urban areas where high volumes of wastes are generated and accumulate. Social influence or pressure should be used to encourage more waste reuse and separation.
2. Increase on Vehicles and trucks that collect solid waste.
3. Increase on the frequencies of collection
4. A land filling site should be constructed in the Municipality to avoid the long distances and long waiting time at the land filling site.
5. Solid waste collection should be allocated more funds to help in health education, buying new trucks and paying workers involved in solid waste collection.
6. Lower solid waste collection charges should be levied to enable people afford the costs.
7. There is need to put personal protection equipment for both municipal gabbage collectors and community members in order to improve solid waste sorting and re-use at house hold level.
8. The government should successfully implement the by-laws present on solid waste management
9. There is need for provision of equipment that facilitates proper segregation and disposal of wastes by the municipal authority.

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