

[Research]

## Municipal solid waste collection and management strategies in Akure, South-Western Nigeria

A. J. Oloruntade<sup>1</sup>, P. A. Adeoye\*<sup>2</sup>, F. Alao<sup>3</sup>

1- Dept. of Agricultural Engineering Technology, Rufus Giwa Polytechnic, Owo, Ondo, Nigeria.

2- Dept. of Agricultural and Bioresources Engineering, Federal University of Technology, Minna, Niger State, Nigeria.

3- Dept. of Agricultural Engineering, Federal University of Technology, Akure, Ondo State, Nigeria.

\* Corresponding author's E-mail: E-mail:pheterhardey@yahoo.com

(Received: Nov.30..2011, Accepted: May.12.2012)

### ABSTRACT

Municipal Solid Waste Management (MSWM) has become the greatest problem facing many urban and semi-urban areas in Nigeria, although to varying degrees. This study suggests the various steps and approaches to combat the menace in Akure in the southwest zone of Nigeria. Such approaches include creation of special agencies for the collection, recycling and conversion of Municipal Solid Waste (MSW) to wealth. The recruitment of Sanitary Inspectors and Volunteer Youth Corps, awareness campaigns and collaboration with other government agencies have improved compliance with sanitary laws, thus helping in effective MSWM and making the city appear aesthetically pleasing and environmental friendly. There is need for MSWM cost sharing between the government and the people, strengthening of all enabling sanitary laws and adequate budgetary allocation for all concerned agencies, involvement of Private Sector Participation (PSP) and awareness campaigns to sustain the present level of MSWM efforts and increase the tempo to guard against future population increase.

**Keywords:** Environment, Management, Sanitary Inspectors, Solid waste, Waste recycling

### INTRODUCTION

Municipal Solid Waste Management (MSWM) has continued to be a major problem in many developing nations of the world. Solid waste management has gradually become a threat to the environment of developing countries as they progressively move towards industrialization (Awomesoet al. 2010). Geoffrey (2005) reported that solid wastes of different categories being generated, had posed a hydra-headed problem beyond the coping of various solid waste management systems in Nigeria. Thus, MSWM has become one of the most serious environmental challenges facing many cities in the country. Ugwuh (2009) observed that in major cities of Nigeria, MSWM is a serious problem, which is in view of the phenomenal increase in the volume of wastes generated in the country. Population increase, rapid urbanization,

industrialization and economic growth are factors responsible for the increased MSW generation. An average Nigerian is estimated to generate about 0.49 kg of solid waste per day with households and commercial centres contributing about 90% of the total urban waste burden (Ogwueleka 2009). Existing information on industrial, agricultural and biomedical waste profiles in Nigeria is still little. Recently there has been a marked increase in the amount of plastic wastes generated in Nigeria, as it is the case with most developing countries; a greater percentage of MSW is composed of organic (putrescible) matter. A typical solid waste management system in developing countries displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of

flies and vermin, and the handling and control of informal waste picking or scavenging activities (Chen *et al.* 2010, Manaf *et al.* 2009). As urbanization and industrialization continue to take place, the management of solid waste has become a major environmental and public health problem in urban areas. These concerns are caused by technical, financial, institutional, economic, and social factors which constrain the development of effective solid waste management systems (Turan *et al.* 2009).

However, despite the generally accepted view that most urban cities in Nigeria lack effective MSWM strategies, the situation varies with cities, governments at the various levels and people (Imam *et al.* 2008). In Akure the Ondo State capital, a lot of effort has been made towards effective MSWM to make the city aesthetically pleasing and environmentally friendly, realizing the importance of the city as a state capital and appreciating the recent rural-urban migration. With the increased economic activities and social status of the people living in the city, successive governments in the state have taken the issue of MSWM seriously. The Ondo State government has set a record in MSWM like its counterpart in Lagos State, Nigeria. Hence, this paper intends to highlight the approaches of the state and local governments to MSWM in Akure with a view to making many other

urban cities to take a cue from such rewarding efforts.

### Study Area

The study area is Akure (shown in figure 1), a medium-sized urban centre and the former provincial headquarters of Ondo province in 1939. In 1976, it became the capital city of Ondo State and a local government headquarters. The state has eighteen (18) local government areas with land areas of 13,595km<sup>2</sup>. Akure is located on Latitude 7° 15' North and Longitude 5° 15' East. The state lies within the sub-humid tropics (Olanrewaju 2009). Over the years, the population of Akure has been increasing tremendously since it started to enjoy the status of both state capital and local government headquarters. Since the rebirth of democracy in Nigeria in 1999, Akure has continued to witness tremendous increase in population as a result of rural-urban migration arising from the influx of many political office holders and their families as well as job seekers. While the 2005 census put the population of Akure at 324,000, the current population of the city is put at 495,000 people. By 2015, it is projected that Akure will be inhabited by about 1.8 million people (NPC, 2009).

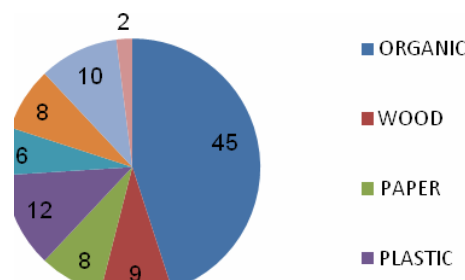


**Fig. 1.** Map of Nigeria showing the position of Akure. (Olanrewaju, 2009).

**Sources and nature of municipal solid wastes generated in Akure**

Akure was an agrarian community before its status changed; many of its citizens were farmers producing cocoa, timber and rubber. However, the new status reduced the dominance of the city by its original indigenes who were predominantly farmers, with government officials, businessmen and artisans now holding sway. Imam *et al.* (2008) stated that level of industrialization, socio-economic status of the citizens and the kinds of commercial activities in various states of Nigeria determine the quantity and rate of solid waste generation. The need to build more

houses to cope with the ever increasing population and urban beautification has recently constituted the sources of waste generation apart from those generated from domestic and market places. Expectedly, the increased population has led to rapidly increasing commercial, social and construction activities. Hence, the MSW hitherto dominated by agricultural wastes has been changed. The city now produces MSW ranging in characteristics from organic to inorganic; industrial wastes, plastics, glasses, wood and paper.(Fig. 2).



**Fig. 2.** Waste composition in Akure, (OSWMA, 2010).

The composition of wastes also varies based on the social status of the citizens. The composition of collected wastes in high income, low income and middle income areas of the city are not the same.

Also, institutional and industrial wastes vary in composition and properties (Table 1).

**Table1.** Percentage Composition of wastes Collected in different areas in Akure

| Waste Composition       | Residential areas     |                         |                      |                    |                     |
|-------------------------|-----------------------|-------------------------|----------------------|--------------------|---------------------|
|                         | High income districts | Middle income districts | Low income districts | Commercial centres | Institutional areas |
| Food wastes             | 48.6                  | 39.8                    | 34.3                 | 36.9               | 40.6                |
| Paper/textiles/leathers | 6.8                   | 8.9                     | 11.2                 | 13.3               | 15.6                |
| plastics                | 7.3                   | 7.1                     | 6.8                  | 10.6               | 6.9                 |
| Glass                   | 3.2                   | 4.2                     | 2.9                  | 6.9                | 6.7                 |
| Metals                  | 6.7                   | 4.8                     | 7.1                  | 8.2                | 6.3                 |
| Sludge                  | 5.9                   | 7.6                     | 8.2                  | 3.5                | 8.6                 |
| Scrap tyres             | 5.6                   | 4.3                     | 2.6                  | 6.1                | 6.3                 |
| Pampers/sanitary pads   | 7.2                   | 6.8                     | 3.3                  | 0.9                | 1.2                 |
| Horticultural wastes    | 6.6                   | 4.3                     | 2.9                  | 2.2                | 7.6                 |
| Others                  | 2.1                   | 12.2                    | 20.7                 | 11.4               | 0.2                 |

Quantitatively, MSW generated in municipality alone based on 0.32kg/cap/day in 2005 was estimated by Kum *et al.* (2009) as about 180,000 metric tons/year. In Akure, increase in salaries of workers in recent times has increased the individual income of household making more varieties of assorted drinks and foods affordable. Increased individual households incomes have also led to frequent throwing of parties in a manner that is a wide departure from the traditional restriction of such to the dry seasons. As a result of these, naming, birthday, and funeral ceremonies and political party programmes/gatherings are held throughout the year. In many of these parties, foods are served in disposable plates, drinks in cans, plastics and bottles,

thus leaving behind at such venues litters of plastics containers, cans, foil papers and bottles. Furthermore, the city also provides ready market for food products like yam, plantain, cocoyam, okra, banana and garden egg. There is prevalence of sawmills in the city and its environs in view of the surrounding thick forest. Peels and decayed farm products are characteristically bulky and thus form the junk of the organic wastes generated. All these have ultimately led to increased MSW generation in the city. Table 2 shows the increased trend in waste collected in Akure city from 2000 to 2010.

There is an increase in waste generated, and because of increased efforts by government to sanitize the city, more of this generated wastes were collected.

**Table2.** Municipal Waste Collected from 2000-2010 in Akure

| Month/Year | Waste Collected ((ton) |      |      |      |      |      |      |      |      |      |      |
|------------|------------------------|------|------|------|------|------|------|------|------|------|------|
|            | 2000                   | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| January    | 206                    | 234  | 218  | 259  | 260  | 243  | 237  | 302  | 344  | 573  | 562  |
| February   | 236                    | 244  | 268  | 254  | 252  | 257  | 209  | 379  | 470  | 602  | 764  |
| March      | 239                    | 247  | 241  | 258  | 256  | 261  | 316  | 418  | 361  | 733  | 804  |
| April      | 232                    | 302  | 261  | 244  | 258  | 249  | 284  | 491  | 483  | 647  | 679  |
| May        | 253                    | 287  | 246  | 286  | 277  | 286  | 281  | 316  | 461  | 635  | 801  |
| June       | 247                    | 315  | 268  | 294  | 281  | 243  | 264  | 417  | 405  | 572  | 639  |
| July       | 238                    | 309  | 288  | 248  | 250  | 261  | 224  | 473  | 369  | 694  | 685  |
| August     | 243                    | 274  | 256  | 251  | 289  | 302  | 291  | 405  | 392  | 756  | 739  |
| September  | 236                    | 318  | 309  | 299  | 278  | 294  | 261  | 456  | 416  | 661  | 742  |
| October    | 249                    | 331  | 226  | 237  | 240  | 248  | 263  | 484  | 361  | 689  | 741  |
| November   | 268                    | 296  | 302  | 313  | 298  | 296  | 271  | 339  | 443  | 548  | 736  |
| December   | 234                    | 364  | 280  | 346  | 352  | 361  | 274  | 407  | 420  | 592  | 646  |
| Total      | 2881                   | 3521 | 3163 | 3289 | 3291 | 3301 | 3175 | 4887 | 4925 | 7702 | 8538 |

### Trends of Waste Generation and Collection in Akure

Generation of wastes is as old as human existence of which Akure is not an exception. Ever before the city assumed its

present status, wastes were generated by the people living in the city. The differences between then and now are the nature and the quantity of wastes generated. In the earliest time, the use of akitan (refuse dump) scattered all over the

city was massively employed as sites for waste disposal. Domestic wastes and all other kinds of wastes were regularly dumped on the designated sites which also served as toilets for the people. During this time, useful plots of land were used and it was the duty of each community where such sites were located to ensure their accessibilities. The common practice then was to put fire on the dumpsites, especially during the dry season, to burn hills of refuse deposited over time so as to reduce dump height and volume (Ogwueleka2009). With civilization and increased population, however, such a practice became inappropriate, more so that owners of such plots hitherto designated dumpsites now found them valuable. Also, increased awareness of the dangers which such practice portends to health, the fact that it makes the environment to be unsightly and establishment of government agencies to collect and manage wastes in the city have made it recently unpopular. Nevertheless, one still finds few scattered dumpsites around the city where scavengers carry out their activities. This makes it necessary to replace this primitive collection and management method with an environmental friendly collection technique.

As a result of the climatic factors like high temperature and humidity and

with high organic matter content of the municipal wastes decomposes rapidly resulting in unhygienic conditions. Hence collection has to be done on a daily basis. At present, different collection methods are being used in Akure; house-to-house collection (primary collection), collection from roadside storage areas, street cleaning and collection of MSW from the streets, and households in handcarts. Thereafter, the wastes are dumped at one of the collection points. MSW is then loaded into transportation trucks, tipper, tractor or automatic compaction vehicles which transport the waste to disposal sites. A handcart or tricycle, a broom and a scraper are provided to each sweeper to sweep the roads, lanes and by-lanes, to clean open drains, collect the waste, load it into the handcart and transfer the same to a secondary collection point in the form of open storage enclosures where vehicles will pack them to disposal points. MSW produced from individual households is taken to the collection point or just deposited at the adjacent roadside from where it is collected when the roads are swept. Sometimes, residents deposit their waste directly into the roadside community bins (Figure. 3) for corporation pickup.

Table 3 shows the available waste collection vehicles for both state and local Government Waste Management Agencies.



**Fig. 3.** Samples of waste bin distributed in Akure.

Though, these vehicles are still inadequate going by increase in population that Akure town is experiencing every day, it will go a

long way to solve close to 90 % of collection problems if the ones that are not operational are repaired.

**Table 3.** Available waste collection, transportation and disposal vehicles in Akure

| Vehicle type                 | Own by state government |             |            | Own by local governments |             |            |
|------------------------------|-------------------------|-------------|------------|--------------------------|-------------|------------|
|                              | Existing units          | operational | percentage | Existing units           | Operational | percentage |
| Lorry                        | 11                      | 8           | 72.7       | 9                        | 6           | 66.7       |
| Tipper                       | 7                       | 6           | 85.7       | 6                        | 3           | 50         |
| Tractor                      | 5                       | 5           | 100        | 3                        | 2           | 66.7       |
| Side loader                  | 8                       | 6           | 75         | 5                        | 5           | 100        |
| Automatic<br>CompactionTruck | 12                      | 10          | 83.3       | 6                        | 5           | 83.3       |
| Total                        | 43                      | 35          | 81.2       | 29                       | 21          | 72.4       |

### Management of the Collected Wastes

Unwholesome waste disposal habits of the citizens as well as funding and sanitation laws enforcement impotency have made solid waste management to suffer set back (Agdag 2009). Realizing the need to arrest the situation, the Ondo State Government in 1999 established the Ondo State Waste Management Authority (OSWMA), an agency to tackle the problem of MSWM holistically in Akure metropolis in particular and the state at large. Since the inception of the agency, many steps have been taken towards improved MSWM in the state generally and Akure in particular. So far, the agency has distributed over 15000 waste bins (figure 3) and polythene bags at affordable costs to households within the metropolis. Besides, it has allocated waste trolleys at strategic places such as markets, hospitals, government offices and educational institutions around the city. The agency also ensures bi-weekly compulsory sanitation exercise at all market sites within the city during which market women are asked to clear all the wastes generated into the collection vehicles with the full participation of the staff of the agency. This is in addition to the mandatory monthly environmental sanitation exercise which takes place between the hours of 7am – 10am every

last Saturday of the month. This exercise is supervised by OSWMA with the support of other government officials and ensures that wastes generated during the period are well managed.

In order to consolidate the success recorded with OSWMA, the state government in June 2006 created out of the existing agency, the Ondo State Integrated Wastes Recycling and Treatment Project (OSIWRTP). The Project commenced operation in December of the same year initially with 84 staff members (Olanrewaju 2009). OSIWRTP was conceived to further accomplish mandate of its mother agency OSWMA which only collect the wastes and dump them in landfills. It has the mandate of recycling MSW and thus creating wealth from it by converting MSW to organic fertilizers. The collected wastes are either incinerated, deposited in a land fill while some percentage of it is recycled into organic fertilizer. This as shown in table 4 has made the percentage of waste that was dumped in an uncontrolled open field to be reduced considerably since the commencement of operation of OSIWRTP in 2007.

**Table 4.** Management Methods for the Collected Waste

| Year | Methods of Waste Management |                    |                            |                |                              |                |                         |                    |                             |
|------|-----------------------------|--------------------|----------------------------|----------------|------------------------------|----------------|-------------------------|--------------------|-----------------------------|
|      | Total collected (ton)       | incineration (ton) | Percentage incinerated (%) | landfill (ton) | Percentage into landfill (%) | Recycled (ton) | Percentage recycled (%) | Open dumping (ton) | Percentage dumped openly(%) |
| 2000 | 2881                        | 801                | 27.8                       | 680            | 23.6                         | -              | -                       | 1400               | 48.6                        |
| 2001 | 3521                        | 923                | 26.2                       | 982            | 27.9                         | -              | -                       | 1616               | 45.9                        |
| 2002 | 2963                        | 782                | 26.4                       | 913            | 30.8                         | -              | -                       | 1268               | 42.8                        |
| 2003 | 3189                        | 928                | 29.1                       | 1218           | 38.2                         | -              | -                       | 1043               | 32.7                        |
| 2004 | 3261                        | 1001               | 30.7                       | 1197           | 36.7                         | -              | -                       | 1063               | 32.6                        |
| 2005 | 3301                        | 1063               | 32.2                       | 1390           | 42.1                         | -              | -                       | 848                | 25.7                        |
| 2006 | 3175                        | 1289               | 40.6                       | 1168           | 36.8                         | -              | -                       | 718                | 22.6                        |
| 2007 | 4887                        | 2067               | 42.3                       | 2136           | 43.7                         | 86             | 1.8                     | 626                | 12.8                        |
| 2008 | 4925                        | 2049               | 41.6                       | 2039           | 41.4                         | 102            | 2.1                     | 733                | 14.9                        |
| 2009 | 7702                        | 3297               | 42.8                       | 3497           | 45.4                         | 289            | 3.8                     | 616                | 8.0                         |
| 2010 | 8538                        | 3594               | 42.1                       | 3807           | 44.6                         | 422            | 4.9                     | 716                | 8.4                         |

Although, the Project is not yet operating at full capacity, it has indeed played a complementary role to the efforts of OSWMA. In fact, the operations of OSIWTRP have led to reduction in the cost of waste disposal, and increased readiness of households to cooperate with waste collectors. Figure 4 shows the quantity of organic fertilizer produced by OSIWTRP between 2007 and 2010.

Awareness campaign programs are also sponsored on the electronic media on weekly and monthly basis by OSWMA on the need for the citizens to embrace good sanitary measures and follow the waste management procedures laid down by the agency especially in Akure. During these programs, convicted violators of sanitary and waste management laws were shown on the television to serve as deterrent to others.

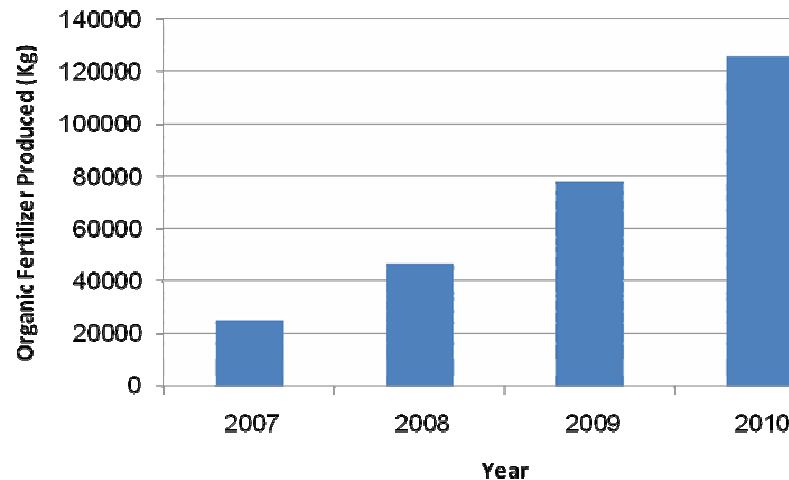


Fig. 4. Quantity of organic fertilizer produced by OSIW RTP

#### Employment of sanitary inspectors and volunteer youth corps.

Recently, the government has strengthened the Sanitary Inspectorate Department of the Ministry of Health with the recruitment of trained Sanitary Inspectors to help ensure compliance with government rules on sanitation. There are also Volunteer Youth Corps who work in conjunction with the Sanitary Inspectors to ensure that MSW are not haphazardly dumped around the city. The two groups have in no small measure inculcated sanitation habits in the minds of many inhabitants of Akure who hitherto would drop water sachets, used plastic bottles and other solid wastes on the ground anywhere around the city. Violators of government sanitary laws are promptly apprehended and arraigned sometimes in mobile/regular courts where they are sentenced or fined when found guilty.

#### Future Challenges

Waste recycling has proven to be far more costly than originally anticipated. The two factors that interactively raise the costs are the categories of materials collected and their collection and handling (Baiand Sutanto, 2002). Collection and handling costs have always formed a large component of material recycling, and the quality of waste materials separated for recycling has frequently been inadequate for direct resale. Waste minimization will remain to be one of the challenges and needs to be implemented more strictly

(Hazraand Goel, 2009). Currently, there is no limitation on the amount of solid waste that may be generated in Akure. While industrial and institutional solid wastes may be more easily controlled, minimization of residential solid waste will continue to be difficult. Residential solid waste is not being currently charged for the generation/collection, and has no limitation/control in the actual quantity or volume of solid waste generated. Even if the regulation is revised and solid waste is to be charged on the basis of weight/volume (i.e. "Pay-As- You-Throw"), the regulation can be difficult to implement. The quantity of solid waste from individual household will be hard to detect and quantify.

#### CONCLUSIONS

From the foregoing, there is no doubt that a lot of success has been recorded in MSWM in Akure owing to the commitment of the government and its agencies. The city of Akure is neater and more environmentally friendly than it was before. This study has established the fact that the problem of MSWM can be reduced in urban and semi-urban cities of developing countries through appropriate attitude and approach. There is opportunity for reduction of unemployment with the establishment of MSWM agencies. However, despite the successes recorded in Akure, the following aspects could still be employed for greater achievements.



There is a need to improve on the present MSWM cost sharing between the government and the people. Sustainability of the present achievement requires raising the levels of cost recovery through appropriate payment for waste services and imposition of waste management taxes on private companies.

All agencies saddled with the responsibility of MSWM should be strengthened with enabling law, adequate budgetary allocation and staffing to ensure that they operate at full capacity. In addition, more stringent measures should be taken to ensure that violators of sanitary laws are apprehended and punished.

Measures for continuous performance improvement in waste management through the culture of professionalism as well as institutionalizing best practices and high environmental standards, including occupational safety will go a long way to sustain the present efforts at MSWM. To this end, opportunity should be created for Private Sector Participation (PSP) in MSWM.

Awareness campaigns should be intensified to educate the citizens on the use of waste bins, bags and trolleys and also disabuse their minds with the notion that MSWM is not their problem thus changing their attitude. A situation where people dump feces inside waste bins or set fire on public waste trolleys before the arrival of waste collectors is barbaric, unacceptable and should be condemned.

#### **Acknowledgement**

The authors acknowledge Ondo State waste Management Authority (OSWMA) and Ondo State Integrated Waste and Treatment Project (OSIWRTP) for data and other information used in the preparation of this report.

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## استراتژیهای جمع آوری و مدیریت ضایعات جامد شهری در آکور، جنوب غربی نیجریه

آ. ج. الورتاده، پ، آ. آدیوی\* و ف. آلائو

(تاریخ دریافت: ۹۰/۹/۹ - تاریخ پذیرش: ۹۱/۳/۵)

### چکیده:

مدیریت ضایعات جامد شهری (MSWM) بزرگترین مشکل در مناطق شهری و نیمه-شهری در نیجریه می باشد که در مقادیر مختلفی از لحاظ سطح آلودگی بروز می کند. این بررسی، مراحل و دیدگاه های مختلف را برای برطرف کردن این تهدید در آکور (Akure) در منطقه جنوب غربی نیجریه پیشنهاد می دهد. چنین دیدگاه هایی شامل ایجاد بنگاه های مخصوص برای جمع آوری، بازسازی و تبدیل ضایعات جامد شهری (MSWM) به ثروت و دارایی، بکارگیری بازرسان بهداشتی و گروه های جوانان داوطلب، آگهی هایی برای مبارزات انتخاباتی و همکاری با دیگر بنگاههای دولتی می شود که با قوانین بهداشتی سازگاری داشته و بنابراین در مدیریت موثر ضایعات جامد شهری و ساختن شهری با ظاهری زیبا و دوستدار محیط زیست کمک می کند. به منظور مدیریت ضایعات جامد شهری نیاز به اشتراک گذاشتن هزینه ها بین دولت و مردم، تقویت تمامی قوانین بهداشتی و اختصاص بودجه کافی برای تمامی بنگاههای درگیر، دخالت بخش خصوصی (PSP) و آگهی هایی برای مبارزات انتخاباتی برای نگهداری سطح فعلی از تلاشهای مدیریت ضایعات جامد شهری وجود دارد و زمان را برای کنترل در برابر افزایش جمعیت در آینده افزایش می دهد.

\* مولف مسئول