

# SOLID WASTE MANAGEMENT IN SURABAYA<sup>1</sup>

*Solid Waste Management Seminar  
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## 1. General Figures of Surabaya

Surabaya is the second largest city in Indonesia. The area is about 290 square kilometer in a coastal and lowland area. The altitude varies from 3 to 10 m above sea level. Surabaya has about 2,8 million inhabitants during the night, and in addition about 300 thousand people commute every day to Surabaya from surrounding areas.

Surabaya is a tropical city. The temperature is almost constant a long the year from 25° in the night to 34° in the day. The average humidity varies from 65% to 85 %. Rainy season starts from October to April, and dry season from May to September. During rainy season, some low land area flooded, the condition becomes worse when some garbage is in the drainage channels.

Surabaya divided into 31 districts in which there are 163 sub districts. Each sub district consists of several neighborhood units. The neighborhood unit is a community organization, which consists of about 200 to 300 families. Neighborhood unit is a forum in which the citizens can share their ideas to improve and to support their living condition. To support the financial neighborhood organization, each member contributes some amount of money for the neighborhood activities including for collection of garbage from each household. (detail in paragraph 3)

## 2. Solid Waste Generation

Total amount of solid waste generated for the whole city, every day is about 7.600 m<sup>3</sup>. It is equivalent to about 1630 tons per day. For calculation purposes, the City uses the standard of 3.2 liter per person per day. Total garbage generation includes from residential and commercial areas. Most of the waste is disposed in landfill site, which is a semi-sanitary method. Some of the garbage is disposed by individual in empty land or even thrown to the surface water. Table 2.1 shows the waste generated by sources

Table 2.1. Waste Generated by Sources (ton/day) in 1993

Sources	Amount	Percentage (%)
Domestic	1,108	68
Market	258	16
Commercial & Industries	177	11
Street & Open Space	83	5
T o t a l	1,626	100 %

Source: Cleansing Department of Surabaya.

## Waste Composition

According to the JICA study which carried-out a survey in 1992, physical composition is dominated by organic garbage. Detailed composition is presented in the Table 2.2. The last JICA study in 1992 is used as a reference for garbage composition. At this moment another study under assistance the city of

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Kitakyushu is being carried out to analyze garbage composition in Surabaya (study will be completed in December 2002).

Table 2.2. Average Physical Composition of Waste (Wet basis).

Classification	Rainy Season	Dry Season
- Paper	13.54	4.37
- Textile	1.85	2.03
- Organics	52.93	55.59
- Wood / Grass	19.15	15.72
- Plastic	7.7	7.51
- Leather / Rubber	0.45	0.03
- Metal (Ferrous)	0.82	0.74
- Metal (Non Ferrous)	0.08	0.16
- Glass	1.12	0.68
- Stone ceramic	1.61	4.46
- Bones	0.62	0.74
- Others	0.13	0.07
T o t a l	100	100

Source: study by JICA 1992.

### 3. Solid Waste Management

Solid waste management consists of three sub components, collection system, transportation and disposal system. The collection system collects garbage from sources. Transportation of garbage from transfer stations to disposal sites is managed by city cleansing department. The third component is final disposal, which consists of semi-sanitary landfill, mini incinerators, incinerator (out of operation) and composting.

#### Household Storage

In the residential areas, each individual equips the house with a household storage. Generally, the storage can be plastic or metal bin or the household storage can be fixed brick-box, which is placed in front of the house. The capacity of the storage varies from 70 - 120 liter. Most of the household storage is open system, meaning that the storage is exposed to the air. So, fly, rats and other rodent animals can easily get into the garbage storage. Generally, household pours the garbage into the storage, then the garbage stays in the storage before collectors take out the garbage another day.

#### Collection

Collection of garbage from residential areas managed by neighborhood units, known as *Rukun Warga (RW)*. The neighborhood organization collects some amount of fee from each household to finance the garbage collection. This institution is a voluntary basis and elected by the community.

In terms of administration, the neighborhood unit is not part of the city government. Each neighborhood organization is an independent unit for managing the collection of the garbage; it is a self-finance organization. The neighborhood units organize the community to provide handcarts, and to pay the collector wage. The responsibility of the neighborhood unit is to collect the garbage from household unit and then bring the garbage to the transfer stations.

Generally, the household storage is fixed-box and open system, so the collection of garbage using bamboo basket to take out the garbage from the storage and put into the handcart, so, the garbage is exposed to the air and some of the garbage is spread out of the handcart. So, the condition is unhealthy to the collectors and to the environment. In addition during being deposited in the household storage, it is often that scavengers looking for some materials from the garbage. The scavengers stir the garbage in order to find out some material they need.

Collection from commercial and institutional areas is undertaken by city cleansing department. Collection of garbage from traditional market carried out by market management. Collection from industrial areas and large size garbage are managed by the sources (generators). In certain areas, private sectors have been involved in solid waste management in Surabaya, particularly for collection and transportation of garbage from commercial areas. The involvement of private sectors is mainly in forms of contract basis for a certain period.

As mentioned before, in residential areas, and collection of street waste undertaken by the community. Meanwhile, cleansing and collection street waste of most of commercial areas carried out by private companies based on contract basis. For commercial areas, street sweepers are responsible for keeping public streets and facilities clean, including city yards, terminals.

### **Transfer Station**

As the garbage collected, it is disposed in transfer station before it is delivered to the disposal sites. There are two types transfer facilities for waste disposal such as:

- a. Transfer stations, with land about 200 - 300 m, in residential area; this type of transfer station supervised by two persons.
- b. Container platforms, with land about 60 - 100 m, in residential and market areas.

The transfer stations equipped with container. A transfer station can consist of one or two containers; it depends on the service area of the transfer station. The collectors from the community neighborhood put the garbage into container in the transfer station. Regularly, truck will take the container to the disposal site.

Most of the transfer stations have a single platform level. Collectors from community neighborhood using bamboo basket to take out the garbage manually from their carts and then put the garbage into the container. So, it takes time to empty the handcart, and in addition, the garbage exposed again to the air, mixing the garbage all together. Generally, the condition of the transfer station is poor.

### **Transportation**

The Cleansing Department under the City of Surabaya is responsible for the haulage of wastes to the final disposal facilities. Transportation system uses containers and dump-truck in various volumes. The trucks take the containers from transfer stations and then bring the garbage containers to the disposal site. The disposal sites are in the west part of Surabaya, which is about 35 kilometer from the center of the city. Another disposal site is in the east part of the city which about 7 kilometers from the center of the city. Since the traffic is very heavy in the city, travel time to the disposal site is too long, so, the frequency of the vehicles is only about two times to the West disposal site.

### **Disposal**

There are three types of disposal in Surabaya, they are sanitary landfill, and composting and mini incinerator. There are two sites for disposal landfill in Surabaya, in eastern part and western part of the city. Keputih Landfill in the east has a total area of 40.5 hectares. Benowo Landfill in the West site has a total landfill area of 16 hectares.

The Keputih landfill is operated since 1982; according to the design it is a sanitary landfill, however, it is operated mostly as dumping system because the garbage is not covered regularly with soil. The Keputih landfill is located in a swamp and flat area; ground water is high and there is no soil deposit in nearest area to cover the garbage. For soil covering purposes, soil must be brought from outside of

Surabaya, which is very far away from the landfill area. During the design of the Keputih landfill, it is far away from residential area, it is in the middle of swamp and fishpond. During design period, the landfill site was not considered to be residential areas. However, at this time, many houses are constructed in the adjacent areas of the landfill. Due to poor operation, the landfill produces smell and odor to the environment. Sometimes, the landfill is on fire particularly in dry season, so, the smoke arises from the landfill, and the smoke disturbs the people and the environment. The people complain about the operation of the landfill. Final complain of the people when they closed the access to the landfill site in October 2001, so, the vehicles cannot deliver the garbage to the disposal site. At the closing of the Keputih (East) landfill, Benowo (West) landfill is under construction. So, for more than two weeks, there is no waste disposal for Surabaya, and the garbage spreads out on the streets in the whole part of the city. After two weeks, the West landfill (Benowo), which is under construction then has to be operated until today.

### **Waste Scavenger**

There has been for long time that scavenger takes part in the solid waste in Surabaya. The scavengers take materials that can be used and recycled from the solid waste. The presence of the scavengers is almost in all part of the solid waste management. During the solid waste being deposited in the household storage; scavengers look for materials they needed. Along the way of the waste from household storage until final disposal site, scavengers are there; they are looking for materials they want to. The presence of the scavengers is almost in every point of the solid waste management.

Accordingly, the scavengers have some advantages for the solid waste management, such as contribution in waste reduction. According to the research by the Institute of Technology 10 November Surabaya, scavengers reduce almost 30% of the waste volume. This number is a large amount of reduction from the whole city. The scavengers reduce transportation cost and disposal cost of solid waste.

Problems associated with the scavengers are the way they take materials from the solid waste. Since there is no separation in the composition of the waste, in order to take recycled materials from the waste, the scavengers stir and mix the waste, so the waste is exposed to the open air. Rotten materials also mixed with paper and other materials; the scavenger activities produce odor and attract rats, fly and other insects. The way scavengers take the materials from the waste is very unhealthy for the scavengers and other people. Therefore, the scavenger activities pollute air and the environment.

### **Financial Aspects**

As part of the city management, solid waste management in Surabaya is also part of the city financial. As explained above, solid waste management consists of collection, transportation and disposal. Collection of domestic waste is carried out by community neighborhood. Therefore, community organization charges their members by "collection fee". For practical reason, collection fee of solid waste is combined with other "community fee" which may consist of security and environment improvement. So, the community only pays a single bill for all community fee in their residential area. The community fee varies from IDR 10,000 to IDR 30,000 (about US\$ 1.1 – US\$ 3.2) for a month. The amount of community fee depends on the living condition of the residential area. The amount of community fee is decided amongst community members.

In addition to collection fee, the citizens of Surabaya have to pay transportation and disposal cost. The amount of transportation and disposal cost depends on the area of house plot. Payment procedure of disposal and transportation cost consists of two different ways. First, households connected to city water supply system pay their solid waste fee through water supply bill. So, the water supply bill includes solid waste fee. Water supply company, then, delivers the payment to the account of the City on a monthly basis. This method is adopted based on assumption that the efficiency of payment will be high. People will be very eager to pay water supply bill, but paying solid waste fee in a single bill is predicted less. Willingness of the people to pay is very low. The water supply company is a semi-autonomous company, which owned by the City government. Therefore, solid waste revenue is based on the amount of water supply connection, which are about 280,000 connections out of about 600,000 properties in

Surabaya. Solid waste fee for transportation and disposal varies from about IDR 6,000 – IDR 14,000 (US\$ 0,55 – US\$ 1.5).

Second, people who are not connected to the water supply system pay the solid waste cost through payment directly to the City sub-district office. The amount of people, who are not connected to the water supply system is larger than the amount connected. However, solid waste revenue from the non-water supply connection is far below the properties connected to water supply system.

Total income of the city from solid waste fee (both for connected and non connected water) is about IDR 15 billion (about US\$ 1.6 million) a year. Meanwhile, for the year of 2002, expenses of the city for transportation and disposal is about IDR 60 billion (about US\$ 6.6 million). The city of Surabaya has to provide a big subsidy for solid waste management. Budget US\$ 6.6 million has to serve about 3 million people. In average budget for solid waste management for each people is only about US\$ 2.2 a year. For the year of 2002, total budget of the city of Surabaya is IDR 980 billion (about US\$ 110 million).

#### **4. Public Participation**

Key element of the public participation is involvement of the community in the decision and implementation process. The opportunity of the community particularly internal city public to be involved is in various phases of the program such as planning, implementation, operation and maintenance. In the collection system, community takes the responsibility in managing their own neighborhood including paying the salary of garbage collectors and street sweeper's, providing garbage bins and containers, purchasing of carts, etc.

Participation becomes a total and continuous process of knowing, doing and learning by all involved parties. Every body is equal in share responsibility, and rewards. The street sweepers, neighborhood community, university students and staff, waste collectors also have the same rights. They are acknowledged as an integrated part of solid waste and environmental management system. All of them have a part in Surabaya's waste management system.

#### **5. Partnership**

There are at least two components of public that contribute to the management of solid waste. The first component is internal city public, which consists sub-components such as, waste generators, community, scavengers, non-government organizations and others. The second component is external city public such as tourists, outsiders, research institutions. The second components are people, organizations, non-government organizations, universities and institution from outside of Surabaya who have direct and indirect impacts to the solid waste management in Surabaya.

The people outside of Surabaya can provide great contribution to the improvement of solid waste management in Surabaya. A lot of knowledge can be learned from other experience outside of Surabaya. Research institutions, non-governmental organizations from national level and international level can provide transfer of know-how to the management of Surabaya. Best practices in other cities can also be adopted to improve the solid waste management in Surabaya. Approach and experience in other cities may help to have a better understanding of solid waste management. Problems in a city can be a good example to be analyzed to find out procedures and technology of problem solutions. Although solutions taken in a city may not be appropriate to be implemented in other cities, however, the way of thinking in a city can be adopted and implemented in other cities.

Partnership can also be an alternative to expand the capacity of the solid waste management. Surabaya and Kitakyushu partnership is a good example of improvement of the capacity of Surabaya. Through the partnership, experience in Kitakyushu can be adopted in Surabaya to improve solid waste management. International forums are venues to share experience from other cities that may provide enlarge horizons and ideas of the city managers. The partnership can be improved to develop a network within cities. Through the network exchange in new technology and information can be carried out. Assistance from city partner can be a catalyst to speed-up the improvement of the solid waste management.

## 6. Disclosure

There are number of issues and problems should be further improved in Surabaya. Some of them are listed below; they to be considered as future action plans.

- a. Reduction of garbage through introduction of the strategy based on 4R approach: Reduction, Reuse, Recovery, and Recycle. Existing reduction system, which mainly carried out by scavengers should be improved, so, it can be healthier and avoid unnecessary things such as pollution to the environment. The scavengers need to be organized and regulated in order to prevent inappropriate of reduction. At the same time other methods in 4R should be adopted.
- b. Public campaign has to be carried out continuously to improve understanding and promoting new approach in management and new technology in solid waste management. The community needs to be informed continuously about anything to be introduced in the city to improve solid waste management. At a certain level, the community involvement as partner in development will promote self-propelling development of the community itself.
- c. Since technology is keep changing and improving, the solid waste management has to follow the new technology that already available. New methods and procedures can help to improve the efficiency of solid waste management.
- d. Institutional improvement is an important part that needs to be improved in Surabaya. As a developing country, institutional aspects particularly law and regulations have to be improved. To support the institutional development human resources should be improved as well.
- e. As explained above, there is a big gap between income and expenses in solid waste management in Surabaya. Expenses is subsidized from other sources such as tax and other city revenues. Financial mechanism in solid waste needs to be restructured to achieve a balance financial condition.
- f. Involvement of private investors is to be promoted. The involvement of private sectors in Surabaya is still very limited. Perhaps, the reason of the limitation of private sectors is insufficient law and regulations. Since most of the private sectors want to be secure when they invest their capital in solid waste management. Therefore, environment for investment should be improved, so the private sectors are eager to do business in solid waste management in Surabaya.
- g. Improvement of partnership with other institutions and cities is very important to expand the horizons of the city and the solid waste managers. City sharing, twinning city, and other forms of partnerships are necessary to exchange experience amongst cities. Seminars and workshops are also venues that can be used to improve capacity of the city.