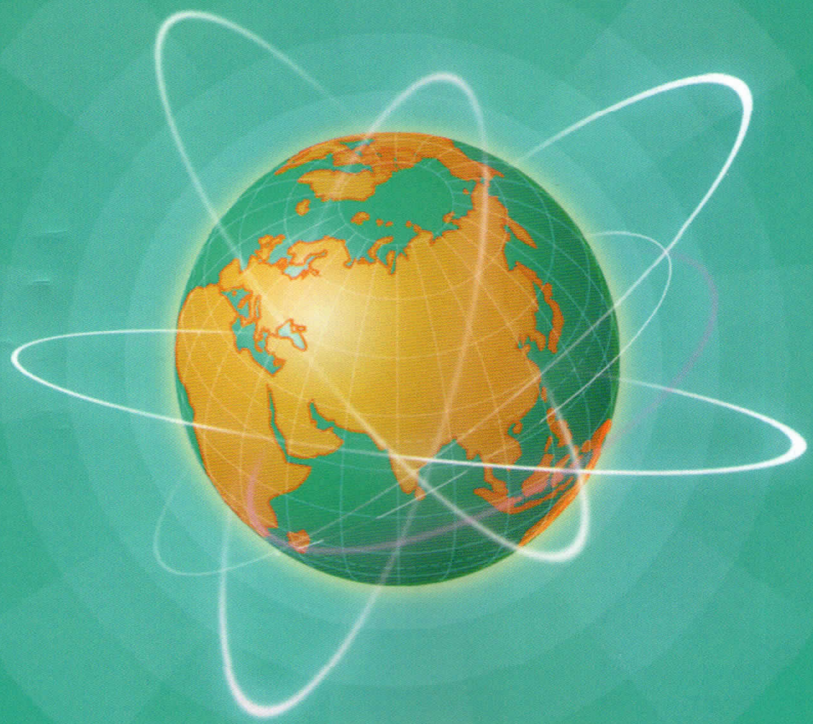
PROSIDING SEMINAR NASIONAL KEBUMIAN IX TAHUN 2014

Fakultas Teknologi Mineral
Universitas Pembangunan Nasional "Veteran" Yogyakarta

Dalam Rangka
Dies Natalis UPN "Veteran" Yogyakarta ke-56

Nomor ISBN 978-602-8461-29-0



Pengembangan Peran IPTEK Kebumian untuk Pelestarian Fungsi Bumi

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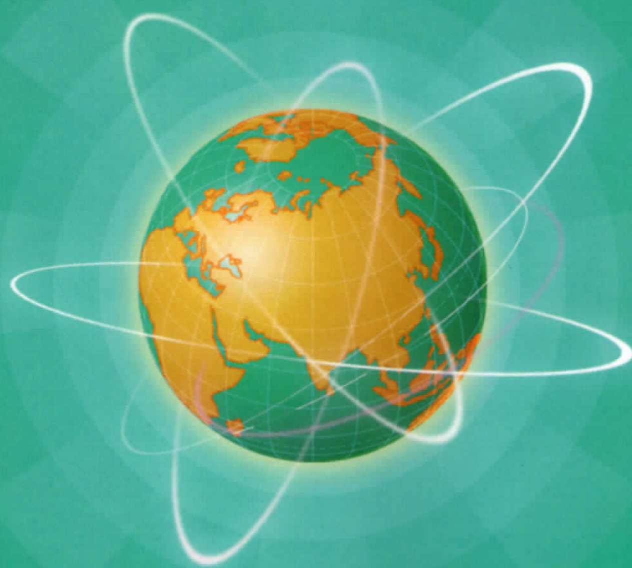

ISBN 978-602-8461-29-0

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Panitia Seminar Nasional Kebumian IX Tahun 2014

Fakultas Teknologi Mineral

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PROSIDING

SEMINAR NASIONAL KEBUMIAN IX TAHUN 2014

Pengembangan Peran Ilmu Pengetahuan dan Teknologi Kebumian Untuk Pelestarian Fungsi Bumi

Yogyakarta, 4-5 Desember 2014

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Cetakan I : Desember 2014

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ISBN 978-602-8461-29-0

DAFTAR ISI

 ISBN 978-602-8461-29-0

EVALUATION OF SUSTAINABLE SOLID WASTE MANAGEMENT SYSTEM IN OSAKA CITY, JAPAN

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ABSTRACT

The problem of solid waste management in Indonesia has been rising since 2000's era. Laws and regulations have been issued but implementation was insufficient. It has been an urgent matter for the government to develop the appropriate system in managing the urban solid waste. The purpose of this study was to observe and evaluate the sustainable solid waste management system in Osaka City, Japan. Methods used was descriptive analysis using field observation for solid waste management from source to disposal completion for 8 subsequent months in 2002-2003 as primary data corroborated with photographs and literature review using official document "Environmental Management in Osaka City for Fiscal Year 1999" by Osaka City Environmental Bureau was in use as secondary data. Result showed that there were only five functional elements of sustainable Solid Waste Management System in Osaka City which was technically carried out by Osaka City Environmental Management Bureau to ensure all the reused and recycled waste were utilized properly and processed with high technology so that it would be zero waste in the end. The elements were: (1) Waste Generation; (2) Waste Handling and Separation, Storage and Processing at the Source; (3) Collection, Transfer and Transport; (4) Processing, Separation and Transformation; and (5) Disposal.

Keywords: *solid waste, environmental management, sustainable, Osaka City*

Introduction

The problem of solid waste management in Indonesia has been rising since 2000's era. Laws and regulations have been issued; innovative and state-of-the-art technologies on solid waste treatment were also available; however, implementation in various urban areas in Indonesia were known inadequate thus created a wide range of adverse effects not only to the environment but also to human health (Anonim, 2001). Solid waste management was described as controlling the generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a proper method that is in harmony with the best principles of environmental considerations related to economics, engineering, public health, aesthetic, and conservation. Moreover, solid waste management should also be responsive to public opinions. Solid waste management involved various actions taken to ensure all problems of solid wastes were solved. The actions included all legal, administrative, financial, planning, and engineering functions to formulate the solution to the problem. The formulation of solution may require complex interdisciplinary relationships among a wide range of science fields such as economics, political, sociology, demography, public health, geography, city planning, conservations, communications, as well as engineering and materials science (Tchobanoglous, 1993).

In practice, solid waste created at source in urban area was placed in one small container which then collected door to door by third party using wheeled cart or small picked up car to be brought and deposited to the nearest Temporary Open Dumping Area (TPS) provided by government. After deposited at TPS, that pile would be transported by government's dump truck/arm roll to the Final Open Dumping Area (TPA), a very large site where solid waste of the

ISBN 978-602-8461-29-0

whole city area were deposited and would be aseptically buried within the ground using Sanitary Landfill Method. People were free to explore the dumped mixed-solid waste pile in TPS and TPA as they might found some valuable things within. Some people were actually doing it for living. Moreover, Sanitary Landfill method was not likely implemented in TPA due to financial and technical issue. Solid waste was just piled on the ground without any sanitary treatment until they resembled a huge mountain of stinky, sticky and slurry repulsive mixed-waste. In consequence, some undesirable unpleasant incidents might come up. One of such cases had occurred in TPA Bantar Gebang in Bogor which was the offsite Final Open Dumping Area for Jakarta Metropolitan City. After 15 years of operation, the people lived nearby had complaint about unpleasant odor during dry season, groundwater contaminated by heavy metal and bacteria which lead to various skin diseases, diarrhea, TBC, and Acute Upper Respiratory Infection. In addition, there was a big explosion of the dumping triggered by methane gas formed in the gigantic dumping pile in TPA Leuwigajah which caused powerful landslide smashing up the housing nearby (Anonim, 2003, Febriani & Sukarjaputra, 2004 & Santosa, 2004).

Problems in managing the solid waste were complex because of the quantity and varied characteristic of the wastes. The problems were worsen with urban sprawling development, governmental funding limitations for public services, technology improvements, and the emerging issue in shortage of energy and raw materials. In order to have a comprehensive understanding of the problems, Tchobanoglous et al. (1993) classified the activities in solid waste management (SWM) into six functional elements which were elaborated as follow:

1. *Waste Generation*

   Activities which involved identification of materials as either no longer being valuable or unusable thus they might be thrown away or collected together for disposal were encompassed in this first functional element of SWM. These activities were not quite controllable. However, a wide range of law and economic instruments might be able to facilitate controlling waste generated in source.

2. *Waste Handling and Separation, Storage and Processing at the Source*

   The activities in this second functional element of SWM were all about treatment of wastes until they were temporary placed in a storage container at source to be collected later on. Wastes treatment was determining the movement from source to the point of collection. The most important thing in wastes treatment was segregation of waste composition at the source of generation, because it would keep the value of wastes materials that could be reused or recycled. For example, papers could not be recovered and/or recycled anymore if they were mixed with leftover foods.

3. *Collection*

   Collection encompassed all activities related to gathering together of solid wastes from source of generation to the final disposal site. The activities included development of wastes collection points and hauling method of wastes. Major consideration in collection was composition of wastes to determine the duration of wastes storage period. The duration of storage period would identify the design of collection points and the method of hauling (Gunawan, 2005).

4. *Processing, Separation and Transformation of Solid Waste*

   Activities in the fourth functional element of SWM involved recovery of separated wastes materials at source, separation and processing of waste components, as well as transformation of waste materials. Separated wastes at source were normally facilitated with curbside collection, drop off, and buy back centers. In general, solid wastes from

 ISBN 978-602-8461-29-0

generation source, either they were separated or not separated, were managed at the processing facilities such as materials recovery facility, transfer station, incinerator, and disposal site. Processing involved the separation of wastes component by size and nature of origin manually or using automatic screening censor, as well as the transformation of waste materials to reduce their volume and weight by performing various physical, chemical and biological process. Transformation by physical process, such as shredding and compaction, was normally executed for non-biodegradable waste materials. Meanwhile transformation by chemical and biological process, such as combustion and composting, was normally performed for biodegradable waste materials. State-of-the-art technologies were the main key in these processes.

5. *Transfer and Transport*

Major consideration in transfer and transport was the size of the city. In small cities, final disposal site was closer, thus development of collection points and hauling method would not be an issue. Meanwhile, in large cities, final disposal site was most likely to be far away from the city, thus transfer and transport facilities were normally required to be further developed. In long distance wastes hauling, transfer and transport activities might have significant financial consequences.

6. *Disposal*

Disposal was the last functional element in the solid waste management system. Major consideration for final disposal activities was to minimize adverse effects to the environment and public health. Moreover, land use planning and environmental impact assessment have been emerging to be significant in the site selection and design of processing facilities and landfills to ensure compliance with environmental protection, public health and aesthetics aspect.

In order to curb the solid waste management issues, Government of Indonesia should find the appropriate technique to effectively solve the problem. Although there are many countries already implemented best practices in managing the solid waste. One of them could be noticed in Japan. Pertain to solid waste and its management issue in Japan, central government had issued laws and regulations about waste classification completed with distributed top-down responsibility on solid waste management. Since the country was lack of natural resources, central government was aware that waste would be valuable if it was not mixed all together thus solid waste management could be set as a part of re-manufacturing industry to get pure raw material, to produce energy and to create sound-environmental land reclamation from waste. The government of Japan believed that technology was one ultimate key to achieve it. One of best solid waste management practices in Japan was implemented in Osaka City. Therefore this study aimed to observe and evaluate the sustainable solid waste management system in Osaka City, Japan.

Methodology

The study was done using descriptive analysis. The methods used in this study were field observation for monitoring the solid waste management from source to disposal completion in Osaka City for 8 subsequent months in 2002-2003 as primary data. Photographs were also taken to corroborate the observation. Moreover, literature review using official document "Environmental Management in Osaka City for Fiscal Year 1999" by Osaka City Environmental Bureau was in use as secondary data to strengthen the observation of the Osaka City's solid waste management system and to get more detailed information required.

Result And Discussion

Solid waste was defined as various mass of unwanted and/or useless throwaways from the urban community and the more akin accumulation of agricultural, industrial and mining wastes (Tchobanoglous et al., 1993). In Osaka City, solid waste in urban area was entitled Municipal Solid Waste. commonly categorized as municipal solid waste (MSW) which included all the wastes generated in a community excluding waste from industrial process and agricultural activities. Meanwhile, the US EPA reports in 1999 considered MSW as wastes from residential, commercial, institutional, and some industrial sources (Franklin, 2000 in Tchobanoglous & Kreith, 2002).

Sources of municipal solid waste were recognized through its definition as follows: (1) residential, (2) commercial, (3) institutional (Tchobanoglous et al.,1993 & US EPA, 1999). Based on the nature of origin, solid waste usually contained organic and inorganic materials. Organic matters were mostly combustible and easy to decompose naturally (biodegradable) whereas inorganics were noncombustible and non-biodegradable. The nature of origin of MSW materials was eminent to determine the next treatments (e.g: storage, collection and disposal). Moreover, based on that quality, MSW materials were often able to be used again or even considered a resource for another item. Sources with each type and compositions of MSW generated were shown in Table 1 below.

Table 1. Sources, Types and Composition of Municipal Solid Waste

Source	Typical locations of waste source	Type and Composition	
		Combustible (Biodegradable)	Noncombustible (Non-biodegradable)
Residential	Single/family homes, duplexes, multi -detached houses, town houses, apartments	Left-over foods, food wastes, disposable diapers, disposable woman's napkins and panty liners, toilet tissues	Paper, cardboard, plastics, textiles, rubber, leather, woods, glass, tin cans, aluminum, ferrous metals, ashes, yard wastes, street leaves. Special Waste*) : bulky items, electronics, tires, cooking oil Hazardous Waste**) : batteries, lamps, tin canned sprays, mechanical oil
Commercial	Shopping malls, markets, shopping streets, shops, stores, restaurants, hotels, office buildings, airports, bus terminals	As above in residential	Paper, cardboard, plastics, textiles, rubber, leather, woods, glass, tin cans, aluminum, ferrous metals, ashes Special Waste*) : bulky items, electronics, tires, cooking oil Hazardous Waste**) : batteries, lamps, tin canned sprays, mechanical oil
Institutional	Schools, medical facilities, prisons, governmental centers	As above in residential	As above in commercial

Source: Tchobanoglous et al., 1993 & Franklin in Tchobanoglous & Kreith, 2002; modified

Municipal government of Osaka City through its Environmental Management Bureau had promoted a Waste Reduction and City Beautification Program as one integrated program to manage the waste of the city as one pertinent environmental issue. Waste reduction principles were created to ensure waste management sustainability thus the city had zero waste in the end, thus reductions with reduce, reuse, recycle and appropriate treatment were be implemented widely and comprehensively from production stage of goods to consumers including changing the behavior toward goods and wastes at all layers. Sustainable solid waste management system in Osaka City was observed through identification of the six functional elements of municipal solid waste management system implemented in the city. Each element was discussed consecutively following the order from waste generation at source to zero waste at final treatment.

ISBN 978-602-8461-29-0

1. Waste Generation

In 1999, Osaka City generated 1,791,000 tons of waste, although it was relatively lower than some years before. The sources of waste generation were classified into three origins which were (1) Waste of Household Origin; (2) Waste of Business Origin; (3) Waste from Public Spaces. The amount of annual waste originated from household was 737,000 tons dominated by Domestic Waste (86.4%) and consecutively followed by Bulky Waste (8.6%), Recyclable Waste (3.6%), and Irregular Waste (1.4%). From business origin, the amount of annual waste was 1,024,000 tons dominated from business activities (91.2%) followed by industrial waste brought to municipal facilities (8.8%). Meanwhile the amount of annual waste from public spaces was only 30,000 tons dominated by Illegal Dumping Waste (50%), consecutively followed by waste from Street Cleaning (26.7%), River Cleaning (16.7%), Public Trash Receptacles (6.6%).

2. Waste Handling and Separation, Storage and Processing at the Source

Although practically there were three origins of waste in Osaka City, this study had focused on the from households. The waste from household must be put and handled separately based on four types which were Domestic Waste, Bulky Waste, Recyclable Waste, and Irregular Waste.

<u>a. Domestic Waste</u>

Items included in domestic waste were kitchen waste, papers, chinaware, dry cells, spray cans, houseware and furniture, electrical appliances and other items not exceeding 30cm in any dimension. The moisture of waste must be reduced before it is placed into a see-through trash bag. Items such as cooking oil must be soaked into papers or cloth, or solidified with coagulation chemical. Items such as spray cans and any flammable cylinders for portable cooking stoves must be deflated to release pressure within, whereas empty lighters and matches must be disposed after extinguishing completely. Meanwhile, sharp objects such as broken glasses, bamboo skewers and blades must be wrapped in thick paper labelled "DANGER" on it and then placed in separate bag for disposal. All trash bags must be discharged before 9:00 AM on collection day.

<u>b. Bulky Waste</u>

Bulky items were any objects that excess 30cm in any dimension (e.g. furniture, electrical appliances, bicycles and many others). Industrial and commercial waste, construction debris and waste resulting from moving out of house were not included in this category. Bulky items should be broken down if possible and then labeled "UNUSABLE" on it. In items such as kerosene stove, the kerosene and dry cell must be removed before putting it as bulky waste. However, due to the Consumer Electronics Recycling Law in April 2001, air conditioners (ACs), televisions, refrigerators, and washing machines had been no longer considered as bulky waste picked up by the city since April 2001. Citizens should take those four items to the retail outlets for disposal and required to pay recycling fee that covers the cost of recycling by the manufacturer and collection fee that covers such waste-keeping cost for the store. Items that retail outlets were not obligated to collect would be collected by Osaka City upon request. Citizens might contact the closest Environmental Management Center if they wished to dispose some bulky waste. Bulky waste wished to be collected by Osaka City must be taken out of the house from 7:00AM to 9:00AM on collection day. In this case, recycling and collection fee were also applied. The amount of these fees was announced in publications such as local government newsletters.

<u>c. Recyclable Waste</u>

Items included in recyclable waste were: (1) metal cans of foods and beverages, housewares, and other items not exceeding 18 liters; (2) metal kitchen wares, housewares and other items

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less than 30cm in diameter and 15cm in height; (3) glass bottles of foods and beverages, housewares, and other items not exceeded 1.8 liters; (4) Polyethylene Terephthalate (PET) bottles of beverages and soy sauce indicated with PET symbol. Items such as cans, bottles and PET bottles should be rinsed with water. The cap should be removed from bottles and PET bottles and discarded as domestic waste. Cans and PET bottles should be compressed if possible. Recyclable waste must be placed in a see-through plastic bag and labeled "RECYCLABLE WASTE" on it. The trash bag should be stored at the collection site by 9:00 AM on determined collection day. If the collection day of recyclable waste coincided with the bulky waste collection day, the bag containing recyclable waste should be placed away from the bulky waste.

d. Irregular Waste

Irregular waste was a large amount of waste generated due to house-moving or any other events.

3. Collection, Transfer and Transport

Waste collection was performed using several means of transport based on the collection spot. Commonly for collection, citizens were requested to use see-through trash bags (fully or semi-transparent) which enable the content to be identified from the outside thus it would be easier to separate the waste, especially the hazardous waste from the others. To promote the widespread use of transparent trash bags, Osaka City certified transparent bags that met specified standard as "recommended trash bags" which were already given a label on the outside of the package to identify their approval by Osaka City. Moreover, to prevent accident from flammable items, the collection vehicle would not collect the following items: batteries used for vehicle, fire extinguishers, harmful chemicals, high-pressure gas cylinders, kerosene oil, minibikes, motorcycles, paint, waste oil, any other hazardous item. In practice, waste collection activities would be elaborated below.

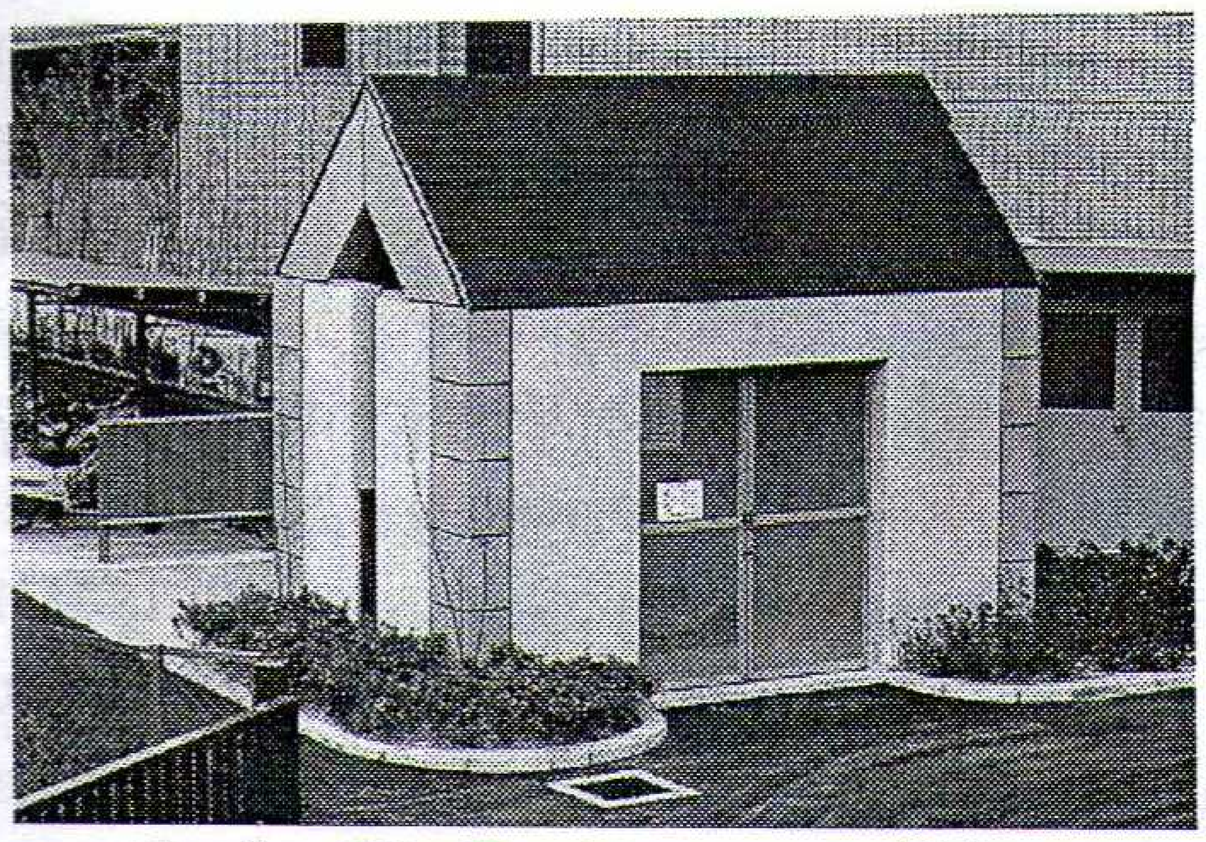
a. Domestic Waste Collection

Domestic waste was collected from approximately one million households using 406 press trucks and 187 lightweight trucks twice a week on specified days (see Figure 1). Collection of waste up to 10kg a day was free of charge. For multi-stories apartment, there was a new ordinance that required the owners to provide facilities for collecting domestic waste and equipment for handling recyclable resources since April 1993 (see Figure 2). The standards for the facilities were set by regulations such as (1) Must be built in proper size and capacity and must not be mixed with other items; (2) Structure must be simple and safe for discharge and collection and must be located in a place convenient for discharge and collection; (3)

Source: Osaka City Environmental Management Bureau, 1999

Figure 1. Domestic Waste Collection in Osaka City

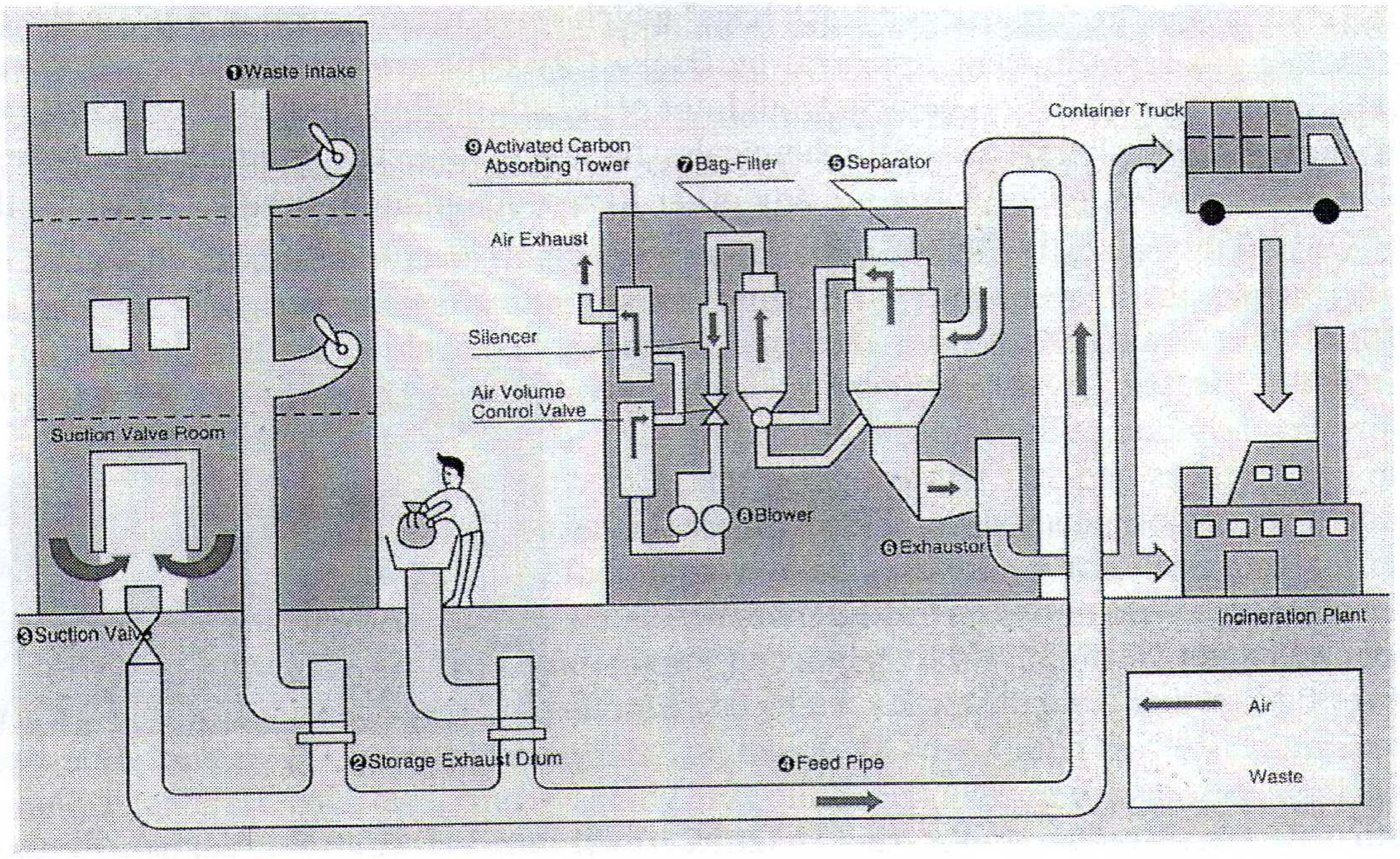
Must be designed in such manner so that waste would not spill out or flow out and must not disperse bad odors; and (4) Must be provided with sufficient water supply and drainage, ventilation and lighting equipment. In some other high-rise apartments, domestic waste was collected using a method called



Source: Osaka City Environmental Management Bureau, 1999

Figure 2. Example of Waste Collection Facility in Multi-stories Apartments in Osaka City

"Pneumatic Waste Collection System". The method allowed waste to be carried through a vacuum-type underground pipe system from each household to a waste transfer station or to an incineration plant (see Figure 3). Nationally, this pneumatic method was adopted in high-rise apartment for the first time in Osaka at the Morinomiya Second Residential Complex (approx 2,000 households) and Nanko Port Town (approx. 10,000 households).



Source: Osaka City Environmental Management Bureau, 1999

Figure 3. Pneumatic Waste Collection System for High-Rise Apartment in Osaka City

b. Bulky Waste Collection
Collection of bulky waste was performed using 78 press trucks and 34 small vans. Large bulky items in excess of 30cm in any dimension were collected by the city about twice a month in response to the request by phone call.

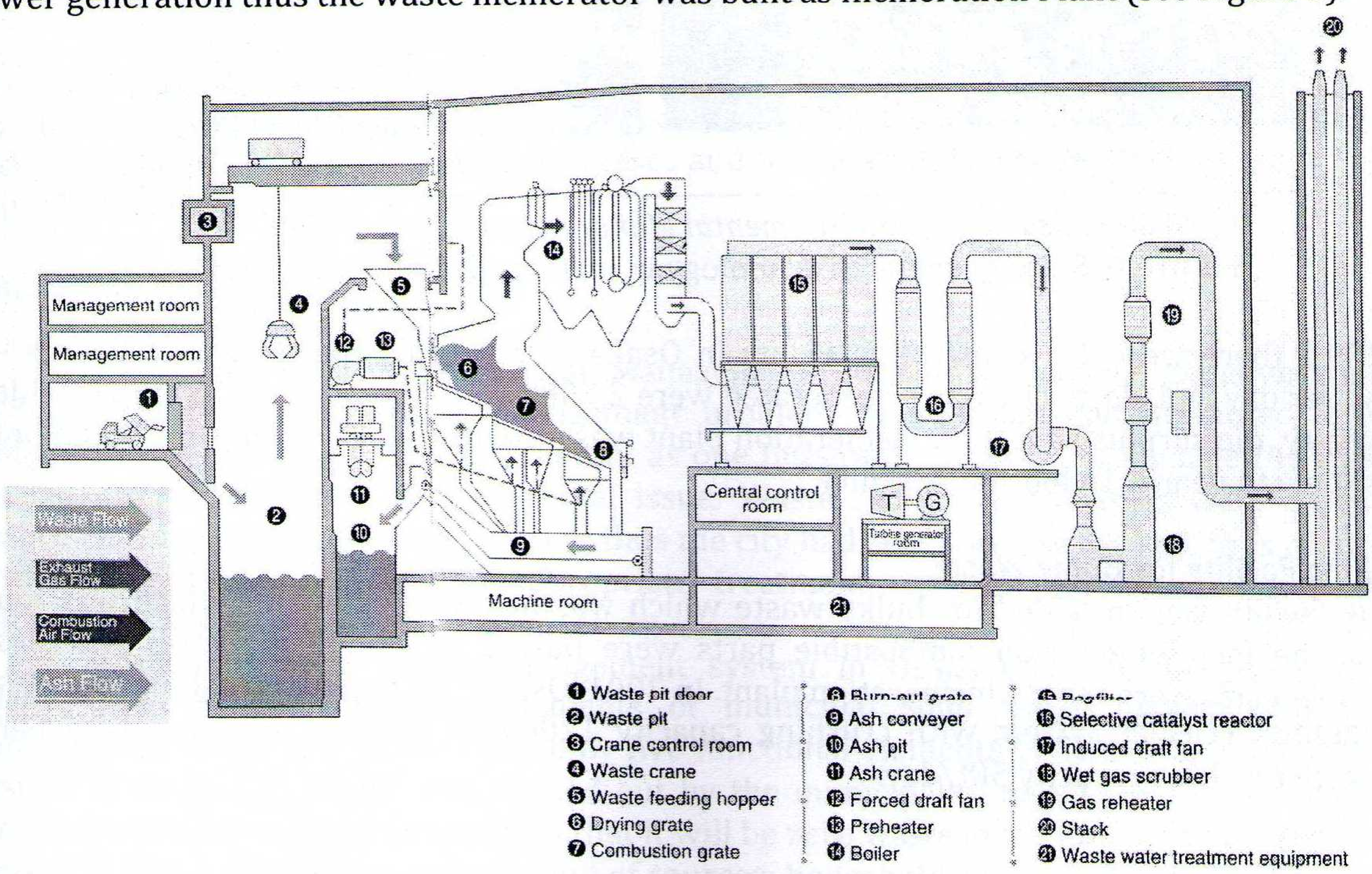
c. Recyclable Waste Collection
Collection of recyclable waste was performed once every two weeks using 79 packers and 26 lightweight trucks. However in Nanko Port Town, special recycling bins had been put out in public area for empty cans, bottles and PET bottles.

d. Irregular Waste Collection
Osaka City would collect irregular waste upon request to the nearest Environmental Management Center. In this case, the charge applied was about ¥1200 for each collection up to 50kg.

4. Processing, Separation and Transformation of Solid Waste

Processing and transformation of solid waste were performed to reduce its volume before it went to the disposal site. Osaka City had several ways to process and to transform the solid waste based on its type and composition which were as follows: (1) combustible waste was burnt in a high-tech incinerator; (2) bulky waste was demolished into smaller pieces at a crushing facility; and (3) recyclable waste was processed at a recycle center.

a. Incineration Plant for Combustible Waste
The main purpose of using incinerator for combustible waste was to reduce the volume of the waste going to the disposal site. However, the process of waste burning produced a great amount of massive heat in return which was considered as thermal energy that could be utilized for many uses. In Osaka City, the massive thermal energy was mostly converted into electricity power generation thus the waste incinerator was built as Incineration Plant (see Figure 5).



Source: Osaka City Environmental Management Bureau, 1999
Figure 5. Waste Combustion Process in the Incineration Plant

In the incineration plant, first the collected wastes were weighed and thrown into the waste pit through the waste pit doors. Wastes in the pit were then moved to a waste feeding hopper by a giant crane which was remote controlled from the crane control room (Figure 6a). The hopper would move the wastes in appropriate amount to the incinerator which was equipped with a drying grate, a combustion grate and a burn out grate. To keep the ambient air quality in the waste pit, unpleasant odor was sucked into a forced draft fan, heated by a pre-heater and fed into the incinerator from below each grate. In the incinerator, the waste would be first dried in the drying grate, then burnt in the combustion grate at a high temperature (approx. 850ºC to

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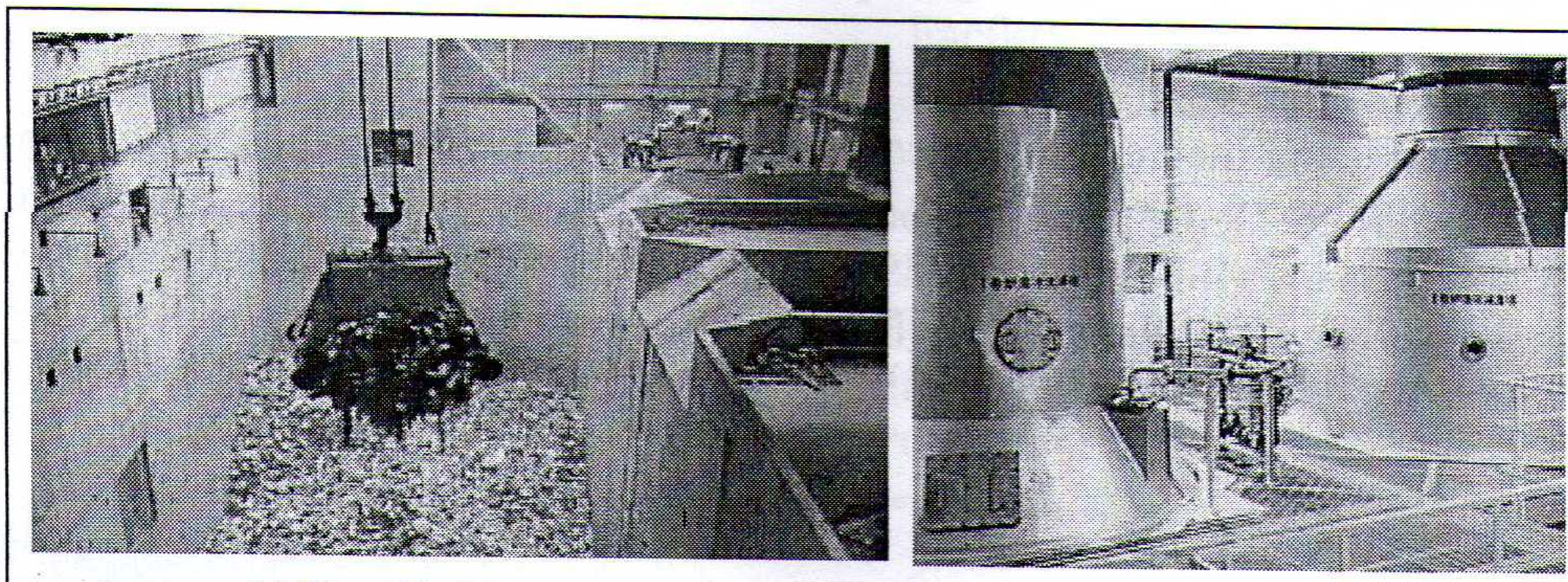
950 ºC) and being turned completely into ash in burnt out grate. The ash was transported through an ash conveyor located in the water and stored temporarily in the ash pit before being loaded into trucks by an ash crane and carried to the final disposal site. To prevent the release of dioxins, the exhaust gas must be maintained at a temperature 850ºC to 950 ºC. The heat was absorbed and cooled by a boiler and the soothed gas passes through a bagfilter to remove the hazardous suspended particles (incl. dioxins) and then get purified. After that, the gas went to a selective catalyst reactor to remove the nitrogen oxide and being sent to a wet gas scrubber (see Figure 6b). The purified gas was reheated by a gas reheater before being released to the atmosphere through a stack. Meanwhile, waste water from the incineration plant was purified through a process of coagulation, sedimentation, filtration in the waste water treatment facility so that it would be safely discharged into sewage.



(a) Waste Pit & Waste Crane (b) Wet Gas Scrubber

Source: Osaka City Environmental Management Bureau, 1999

Figure 6. State-of-the-art Technology in Incineration at Osaka City

Until 2001, there were 10 Incineration Plants in Osaka City whose capacity were 200tons – 450tons per day and electricity power generated were 2,750kw – 32,000kw (see Table 2). Aside of electricity, the surplus heat from incineration plant was also utilized as steam supply and hot water supply to nearby Indoor Pool facility.

<u>b. Crushing Facility for Bulky Waste</u>

Crushing facility was provided for bulky waste which was not combustible or which was too large for the incinerator. Non-combustible parts were buried as landfill materials whereas combustible parts were sent to incineration plant. In 2001, Osaka City had two crushing facilities using hammer crusher system with crushing capacity 120t-140t per day and shear crusher system with crushing capacity 50t/day.

<u>c. Recyclable Resources Sorting Center</u>

Collected recyclable waste was carried into Recyclable Resources Sorting Center to get processed appropriately. Recyclable waste needed to be carefully managed in order to be able to reuse the resource in the waste materials. First, the recyclable materials were meticulously sorted again in precisely similar type and composition. After sorted thoroughly, then each specified type of waste was compressed into flattened cubical form to facilitate transport and storage.

Other item mixed in one specified type of recyclable waste caused impurity in processing the resource. For example in recycling the PET bottles, the bottles would be processed into millions small beads called PET pellets to facilitate the transport, storage and reusing to make new PET bottles. The presence of resource impurity in the process would be noticed in the quality of PET pellets. Reusing impure resource material would have an effect on the quality of the product. For

ISBN 978-602-8461-29-0

example impurities in recycled glass resource would form such an air bubble in the new glass bottle.

5. Disposal

After all wastes were crushed and incinerated, the remnants and ashes were taken to final disposal site to be buried as landfill materials. In Osaka City, there were two sites for final disposal. The first site was a reclamation site called Hokko Landfill Site (Yumeshima) as large as 730,000m^2 at the offshore of Konohana Ward. The other site was located in Osaka Bay as a land reclamation project in the offshore of Amagasaki at Hyogo Perfecture and the offshore of Izumiotsu at Osaka Perfecture. The project was called "Osaka Bay Phoenix Project" which was a joint program between Osaka Perfecture and Hyogo Perfecture for establishing a proper final disposal of the Kinki Region.

In Hokko Landfill Site, the transport of waste started at the Hokko Relay Station as a barge loading station. Waste remnants and residual ash were brought to Hokko Relay Station to be loaded into barges that conveyed them to the reclamation site. The barge was towed by a tug boat. On the way to reclamation site, the loaded barge was covered by a spread sheet to prevent scattering of the waste. When it arrived at the reclamation site, the waste was unloaded into trucks (10 units) by cranes. After that, the waste was piled up to fill the reclamation site. The pile was layered between waste at 3m height and soil at 50cm height.

To prevent leakage of hazardous substance, water-tight revetments and heaped earth were in use around the landfill site. To ensure the quality of sea environment, water quality and the seabed nearby were regularly monitored for pollutants. Polluted water would be treated with coagulation and sedimentation processes and floating aerator would be additionally in use to purify the waste water.

Conclusion And Recommendation

Osaka City had Environmental Management Bureau to manage its environmental problems, such as solid waste management problem. The bureau had promoted a Waste Reduction and City Beautification Program as one integrated program to manage the waste of the city as one pertinent environmental issue. Waste reduction principles were created to ensure waste management sustainability thus the city had zero waste in the end, thus reductions with reduce, reuse, recycle and appropriate treatment were be implemented widely and comprehensively at all layers.

Sustainable solid waste management system in Osaka City was observed through identification of the functional elements of municipal solid waste management system implemented in the city. There were only five functional elements of Solid Waste Management System in Osaka City which was carried out by the municipality to ensure all the reused and recycled waste are utilized properly so that it will be zero waste in the end of the process, which were: (1) *Waste Generation* at three kind of sources: household, business and public spaces that determined the type and number of facilities provided for handling, separation, storage and processing at source; (2) *Waste Handling and Separation, Storage and Processing at the Source* which had waste category such as domestic, bulky, recyclable and irregular waste that determined the method of waste collection, transport and transfer; (3) *Collection, Transfer and Transport* which was performed using several means of transport based on the collection spot and a hi-tech Pneumatic Waste Collection System for some exclusive apartments; (4) *Processing, Separation and Transformation* that were mainly implemented with state-of-the-art technology to reduce the volume of waste until final disposal and to convert waste into electricity and thermal energy using incineration plants as well as to reform waste into raw materials using recycling process; and (5) *Disposal* which used the ash from incineration plants for land filling materials in a Land Reclamation Project in Hokko Island.