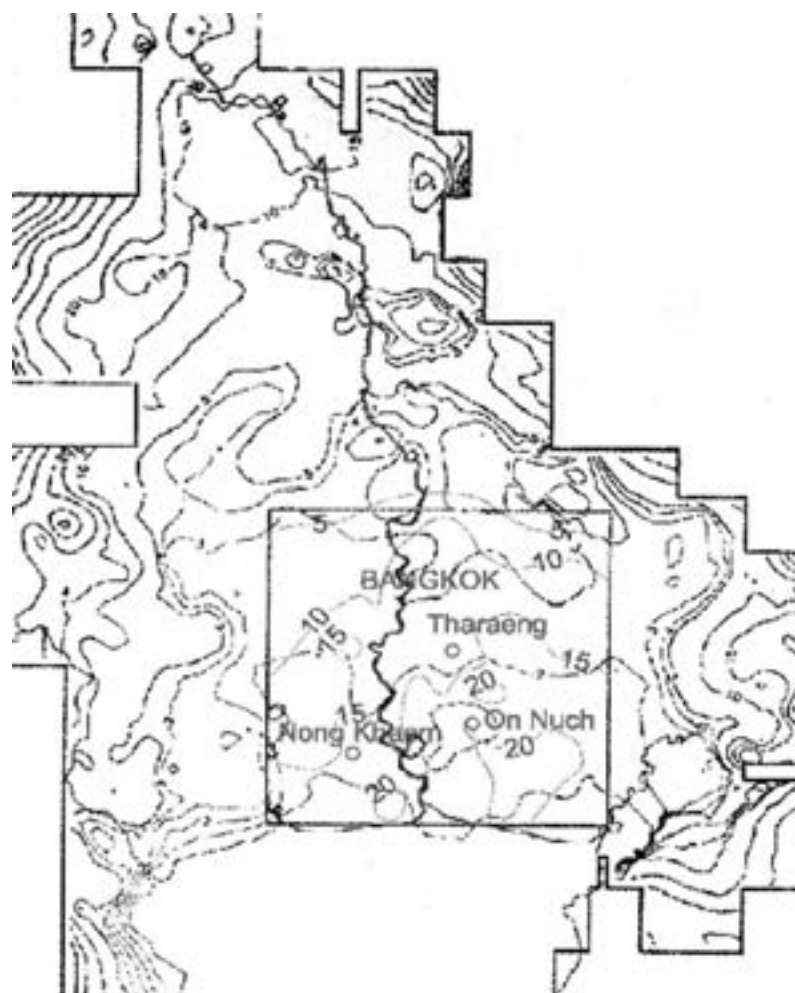


Bangkok





Bangkok

Municipal Solid Waste Management: From public-operated to shared management and financing.

Bangkok is now facing new waste management constraints: environmental and financial ones with the aim to make it affordable for all. Faced with this situation, the BMA is today evolving in its ways of dealing with these evolutions to better implement waste management actions.

*Discussant : Associate Professor **Lye Lin Heng**, Deputy Director, Asia Pacific Center for Environmental Law, Faculty of Law, National University of Singapore.*

Michel VALIN, consultant, SOGREAH

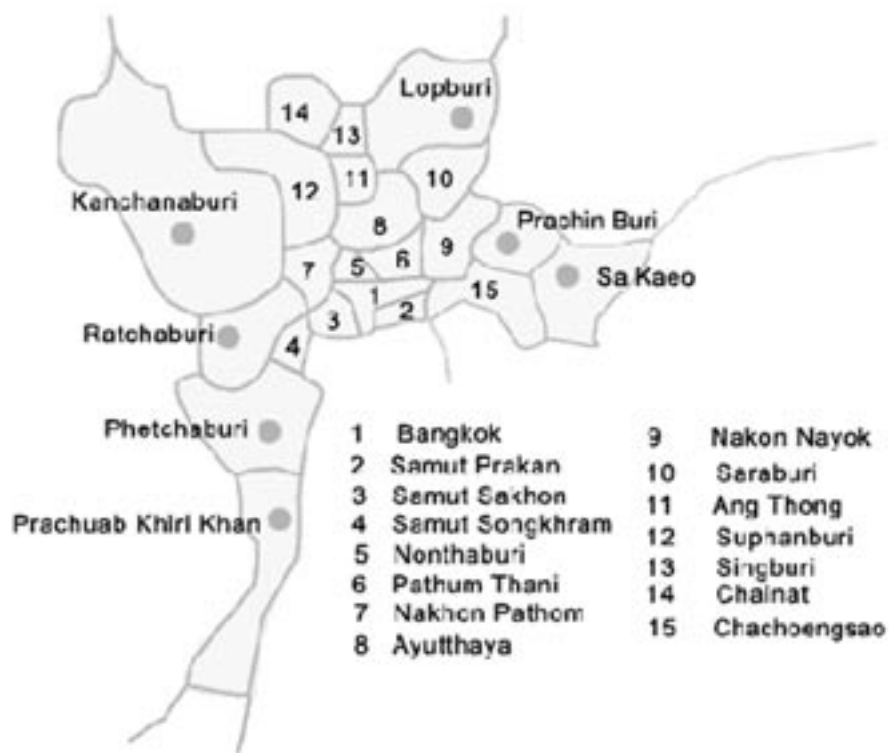
Institutional and legislative framework, processes and waste flows related strategy, environmental background and social impacts, private sector participation, financing.

Ms. Benjamas Chotthong, Project Manager, Thailand Environment Institute

Ways environmental issues related to waste management have been taken into account in the Bangkok waste management process. Role played by the environmental NGO community.

Discussion





- Bangkok metropolitan administration : 1562 km²
- 51 districts
- Annual rainfall (1999) : 1756 mm
- average temperature from 21.5°C to 30.3°C

- Registered inhabitants: 5,663,000
- Unregistered inhabitants : 1,292,000
- Commuters : 1,357,000
- Tourists equivalent inh.: 127,000
- TOTAL inhabitants: 8,438,000

Bangkok Municipal Solid Waste Management: from Public Operated to Shared Management and Financing

Michel Valin

SOGREAH Consultant

Abstract

This paper will first present the opportunities and constraints regarding solid waste management in Bangkok. It will then expose our studies regarding waste collection, areas of responsibilities (public/private sector), transfer (and treatment) sites, waste disposal to analyse the present situation of solid waste management. It will also present the environmental background and the social impact through a brief study of the process related qualitative appraisals, the laws and standards on pollution control in Thailand and the public awareness programme.

To better understand the private sector participation today and its potential future participation, this paper will examine the BMA's objectives, the definition of the contractor/operator's role, the conditions for these contracts and the modes of participation and regulations.

Finally, I will conclude with the financial standpoints and key issues as they appear to us today. To give a better view of this issue, an appendix on the institutional and legal framework that serves as basis for managing waste in Bangkok has been added.

Introduction

This paper will focus on municipal solid waste, so all considerations dealing with industrial or construction waste is not part of this presentation.

The case of Bangkok differs from many others and Bangkok has a long way to go to learn to manage and deal with comprehensive waste management.

Present Situation and Findings

Bangkok municipality

The supreme authority for Bangkok municipality is the BMA (Bangkok Metropolitan Administration) and, placed under its responsibility, there are several departments. One of these departments is in charge of the management of solid waste: the Department of Public Cleansing, which has the responsibility to collect and eliminate waste. Waste collection across the whole Bangkok Metropolitan Area is done by its own workforce and waste transfer to the landfill and elimination has been contracted to private contractors. That's briefly the area of activity and responsibility of the Cleansing Department for the operations. For the planning, they are theoretically in charge of the implementation of a plan for the future management of the waste and for improving the conditions of waste collection and waste treatment in Bangkok.

Bangkok is a huge administrative area of more than 1 500 square kilometers and today the population amounts to about 8.5 million people. The characteristics of this population are rather unknown and especially the commuters, the



unregistered inhabitants, the migrants. In this area, the activity of waste collection is under the responsibility of the Cleansing Department, but it is also operated by each districts. There are 51 districts in Bangkok which manage waste collection. As an indication, the revenue per capita in Bangkok is about 6,000.00 USD and the minimum wage is 162 Baht (1USD = 40 Baht).

Legal tools and framework

The legal tools, around which the waste management is articulated, include 3 areas. At the national level, there are legal tools concerning the framework of the administration, the functioning of the operations of the waste management and mainly the 3 Acts which all were stated in 1992: Public Health Act (stipulating that BMA is responsible for the management of the waste, that is to say the collection, the treatment and the elimination of the waste), the Factory Act (defining the responsibility in terms of environmental impact for the factories, for the industries in the BMA area but also in other cities and territories of Thailand), the Public Cleanliness and Orderliness Act (dealing with the cleaning of the streets). There are also two other important acts, which are the Conservation and Environmental Quality Act (giving the framework of the regulation concerning the emission of gas for incinerations, the framework for regulating the management of landfills and it also gives the opportunity for a framework for future development of technologies like bio-technology for waste treatment). The other legal framework is the document which permits the PSP in this area for waste management. It stipulates that the Private Sector could be involved in the waste management for projects higher than 1 million USD and it gives indications about the land acquisition or land property that has to be integrated in the cost of the whole project. We have also other legal documents on requirements, which are prepared and imposed by the Thai authorities, mainly by the Ministry of Science and Environmental Technology, regarding the particular impact of waste treatment and for the management of ground water quality. At

the BMA level, there are also other ordinances and requirements giving more precise requirements concerning the day-to-day operations for the cleanliness of the city.

Present situation of Solid Waste in Bangkok

Amounts of waste

Municipal waste amounts to about 9000 tons a day, representing a quantity of waste per person of a bit less than 1kg per day per capita. In other terms, it is a quantity of waste of about 3.3 million tons a year produced by the people, the commercial activities and light industries. Toxic waste is not included in these figures, but represents a small quantity of waste. We can estimate, from the figures we had in hands when we analyzed the past conditions of waste in Bangkok, the rate of increase between 2.5 and 3% per annum, which is a realistic figure. According to this trend, we can estimate, at the horizon of 2015, a quantity of waste of about 13 000 tons per day.

Waste collection

Concerning the collection aspect in Bangkok, it is highlighted by the fact that for the fleet of vehicles involved in waste collection there is little control maintenance operations of the fleet and this activity is managed separately by most of the 51 districts. Another factor showing that there are a lot of vehicles in use compared with what we know in the other countries in the region is the fact that we have an informal sector for recycling the waste along the collecting routes of the waste. It then induces longer periods of time from waste collection to the transfer station. We estimate the quantity of informal recycled materials to about 10%.

Waste transfer sites

Concerning the transfer of the waste, we have basically three main sites, located in the North, in

the East and in the West of Bangkok. These sites belong to the BMA and these are former landfill sites, but as the city expanded in the last 20 years, these landfills sites were abandoned and moved to the outside area of the Bangkok Metropolitan Area. Today, the landfills sites are located about 70 km from Bangkok for the West site and another landfill site is located near the sea, in the South East of Bangkok, about 30 to 40 km from downtown. All the daily collecting trucks arrive in this transfer site, and the quantity of loaded waste on the trucks is divided between the 3 sites. Concerning the North transfer site in Tha Raeng, the quantity of waste is normally sent to the West landfill disposal site. In the West site, we have about 4000 - 5000 tons a day, and for the South East landfill site, we have a little bit more than 3000 tons a day.

Concerning these transfer sites, the intention of the BMA is to complete the sites, to attract recycling industries or waste treatment industry at these sites.

These sites were formerly dumping sites. They are now clean except that the soil is still at the natural ground level, and underneath there remains from 2 to 4 meters of un-cleaned waste. At this location, in the recent past, the BMA had already implemented some industrial activities, treatment activities, which focus mainly on composting. They had a pretty good experience in composting to treat part of the waste for the last 30 years. Today, all these activities have been stopped or abandoned. The latest plant, which was in On Nuch and which used to treat a significant portion of the waste (i.e., more than 1 000 tons a day) has been closed. This plant was operated by a foreign contractor who left 3 years ago for commercial reasons and because of local difficulties concerning the management of the rejects. Today, the objective of the BMA is to start again the composting experience by rehabilitating the On Nuch plant. But the client is very careful today about this experience, even if it is willing to continue and to extend this experience. It is trying to formalize a contract frame, which would be better than what it experienced in the past.

Recycling

Today, nothing or very little is done in Bangkok to recycle, this is done under the informal sector. There is absolutely no treatment of the waste, that is to say 90% of the waste is taken to the landfills and there is no industry, either for composting or for treatment of the waste using bio-technology or even incineration. There is an incinerator in Bangkok for hospital waste, in On Nuch, in the East transfer station. In fact, this incinerator cannot meet all hospital waste requirements.

Concerning the disposals, I told you we have two landfills, one in the Southeast and one in the West and they are operated by private contractors. I would say these activities are performed under a service contract. But the land belongs to the private contractors.

Collection costs

The cost for collection (by treatment cost, I mean cost for sending the waste to landfills) is pretty high compared with the revenues collected by the BMA because the collection fees are almost negligible.

Proposals to Improve the Situation

Implement a comprehensive plan

In fact, in the BMA, there are difficulties to implement a management plan. In Bangkok, a very comprehensive plan has yet to be created. Attempts at elaborating and implementing plans have been made and some plans exist: there are plans for collection and plans for final disposal, but this should be complemented by other activities today, in order to cope with the next 20 years for managing waste in Bangkok. The future for Bangkok could be a combination of different activities of treatment and disposals.



Constraints

Bangkok is located in a flat plain, and there are no constraints regarding landfills outside the parameter of the Bangkok Administration.

Opportunities for industries

There are good opportunities for industries to get interesting tariffs of electricity; there are possibilities of agreement with the Electrical Generating of Thailand and also with the Metropolitan Electric Authority. So, there is a possibility to produce and to deliver electricity to this community, to these industries from the recovery of energy from the waste.

Incineration

Incineration has been proposed, there are some undergoing projects launched by the Japanese to propose incineration in Bangkok.

Proposed targets for management development

There is no restriction for one technology to be adapted to the case of Bangkok. Based on this general criteria, the proposal which was made to the BMA, is a proposal of phasing the investment combining this entire elementary scenario and the treatment processes. Implementing the process for the methanization and incineration options in the next 5 years is rather mainly for investment-costs related reasons. For the next 15 or 20 years, a target to have final disposal in landfill about 50% to 60% would be more adapted than a figure of 35% at the horizon 2020.

Based on this scenario, we have some ideas about the cost of what could be the investment for the Bangkok municipality and it is obvious that today the BMA cannot afford to have an integrated waste management, which includes all these components and the authorities will have to choose among these scenarios and possibilities. What seems rather feasible within the next five years is to redevelop the composting system

for 1000 to 2000 tons per day, with a maximum of 2000 tons a day, and to develop biotechnologies, within the next 5 or 10 years.

Concerning incinerations, they are already some proposals, but due to huge investment costs, this is also questionable for the short-term horizon; the BMA will probably continue to manage with landfill and with the present difficulties due to the complaints from the population, and especially in the South-East of Bangkok. There are some law procedures already implemented to close one of the two landfills. This will create huge difficulties in the next months (maximum 2 years) for the BMA to export the waste to new landfills.

Private Sector Participation

The BMA already has experiences with the private sector. Past experiences, which were not very successful regarding the composting. Today's experience mainly focuses on transportation of the waste from the transfer station to the landfills sites. The transportation of the waste is of medium quality regarding the environmental conditions, but the price is acceptable by the BMA. There are some expectations from the BMA to improve this situation, to reduce the cost of transportation, and to implement, in parallel, other solutions of treatment at the transfer sites. They have grounds today to develop an alternative concerning waste treatment but the contract framework has to be settled by the BMA and other authorities in Thailand in order to guarantee the quality of the service but also to attract the private sector in this business.

The experience of the BMA concerning the past and present operations had different successes. For waste collection and transfer, since they operate under service contracts, the contractors have the obligation to load and to transport the waste and to manage the landfills sites. The landfills sites are the property of the contractor and there is no intervention from the BMA in the manage-

ment of the landfills sites. The control of the quality of the disposal and the control of the management of the landfills is theoretically done under the responsibility of the Ministry of Science and Technology.

Regarding the future for the implementation of contracts, the situation today in the Department of Public Cleansing is that this department has little experience concerning the possibility to attract foreign investments and to negotiate with foreign investors concerning waste treatment.

Types of contracts

Basically, the type of contract depends on the scope of the works and also on the willingness of the Authorities to more or less attract the private sector. In waste management, the forms of contracts are mainly concessions or service contracts. Waste collection and managing infrastructures such as composting plants, incinerators, are more or less controlled under a kind of BOT contract.

Improvements and adjustments

The two parties have in fact some obligations and duties, but it is true that to attract the private investments the authorities should clearly define the functions of all the parties and the expected results for the project. In addition to the already existing regulations in Thailand, some improvements need to be made, especially adjustments concerning regulations between different administrations. There are co-ordination difficulties between administrations, which make the role of the BMA and the Cleansing Department more complicated in managing contracts between these different regulations. Of course, the role of the public sector in waste management should be, as in the water sector, to regulate the contracts in terms of technical and economical matters.

Financing the Proposals

Fee collection

The financing of projects for waste management is as difficult as for the wastewater management, that is to say the collection of the fees of the waste is difficult to implement, generally speaking, in Thailand. This would remain the responsibility of the public sector and the administration of Bangkok. The recovery of tax can be done by different means, but it is more than uncertain to see in the near future private companies acting in the field of bill collection.

Contract management of specific facilities

For contract management of specific facilities, this is more obvious and there are more opportunities to contract precise facilities for waste collection.

Responsibility and risk sharing

For waste management and for Bangkok, the parties will have to share the risks. First, they will have to identify the risks as upstream as possible concerning the public sector to have a very precise tender document on specifications in order to avoid some blanks, some gaps. Public and Private sectors will have to share some responsibilities and risks for the management of the facilities and for the management of the whole waste in the projects. The level of the risks is, most of the time, the level of the commercial risk. For example, for a composting plan we have the cost of investment for new infrastructure, which is not specifically a commercial risk, because this can be more easily managed by the private contractor, but the commercialization of the compost, and especially in Thailand, is a real issue to guarantee the future of this activity. Even if today there is a willingness from the BMA to redevelop this sector, it is sure that this issue concerning the composting will require long discussions at the authorities' level.

Conclusion

What must be highlighted is the fact that in the near future the BMA will continue to run landfills and maybe implement a new landfill and will start thinking about other technologies to treat part of the waste. For Bangkok, for the BMA there is no other option but to take this direction, but this will take some time. In the next 10 years, they will probably have to continue to examine and to check these opportunities and, in parallel, they will also have to explore different contract formats which suit as best as possible the local conditions. ■



Appendix 1

Michel Valin

1. SOLID WASTE MANAGEMENT IN BANGKOK : PRESENT SITUATION AND FINDINGS

1.1. GENERAL FIGURES

Bangkok Metropolitan Administration has an estimated population of 8 437 699 inhabitants in 2001 . This value takes into consideration registered as well as unregistered, commuters and tourists- equivalent inhabitants .

The actual quantity of waste , collected by Public Cleansing Department of BMA , amounts to 9022 tons per day , in year 2000.

Given the annual rate of increase of the solid waste of 2,74% , the projection of waste growth based on current trends will bring to a forecast daily production of 13000 tons by the year 2015 . This includes solid waste of any kind produced by the households and non toxic waste from industries and businesses currently collected by the Department of Public Cleansing (DPC).

1.2. COLLECTION

Collection of raw wastes is done with a 2347 vehicles fleet, of which 1306 are currently utilised, and a 7007 persons workforce .

The proposed separate collection scheme (Two compartments trucks, garbage bins) has not been implemented yet by DPC .

Separate collection and sorting of recoverable materials is done anyway by the collectors on their own while collecting the waste . Segregation of the valuable items is done whenever possible on the way between the street and the transfer station, therefore decreasing the productivity of the system.

As a matter of comparison, another Asian city like Kuala Lumpur will collect 7660 tonnes/day with a 565 vehicles fleet.

The unformal system of separate collection allows

for an estimated 7 to 13% recycling ratio of the waste .

While the recoverable materials are dumped en route to companies yards, the trucks deliver the remains to the three transfer stations of On Nuch, Tae Raeng and Nong Khaem.

Hospital waste , to be incinerated at On Nuch site, are collected on a private contract basis.

1.3. TRANSFER (AND TREATMENT) SITES

Two of the transfer sites include other activities or equipment than those involving transfer of the waste : Hospital waste incineration, composting plant (stopped in 1996 after private operation) and night soil treatment plant (management by the nightsoil treatment Division) in On Nuch, nightsoil treatment plant (nightsoil treatment Division) and wastewater treatment plant (under construction by Sewerage and Drainage Department) in Nong Khaem.

Environmental conditions of the three transfer stations are average, while the hospital waste incineration plant at On Nuch (privately owned and operated) does not follow the manufacturer's specifications (furnace temperatures).

Transfer stations are owned and operated by DPC itself .

Composting of the waste has been a long tradition of Public Cleansing Department , with six plants operated in four different locations (including transfer sites) from the sixties . On Nuch last plant (1200 T daily capacity) was constructed and operated on a private basis (P & C - Voest Alpine Joint venture) . It was stopped after a two and a half years operation because there was no contractual arrangement about how the disposal costs of the rejects would be covered leading to an operation loss for the contractor .

The consequence , although compost is a much needed input for farmers and the biological treatment of the waste very much supported by techni-

cal institutes in Thailand (AIT), is that the product distribution network has to be reconstructed entirely on new basis .

1.4. DISPOSAL OF THE WASTE

Transport and disposal of the waste to the landfill sites outside of Bangkok is done under private contracts with BMA .

The waste are dumped through the transfer station's hoppers into the contractor's trucks . The waste from Tae Raeng, Nong Khaem and On Nuch transfer sites are transported to landfill located the Bangkok metropolitan area.

There is no recovery of the waste in Bangkok for the time being apart from the recyclable materials informal collection system and some form of biogas recovery at Kamapaeng Saeng (private site).

In particular there is no organic matter or energy recovery.

Disposal of industrial toxic waste is not under the responsibility of Department of Public Cleansing. Household toxic wastes arriving at transfer stations are not treated because of the costs .

1.5. REVENUES AND COSTS

The costs are divided into collection costs which are the direct expenses of BMA (Or the districts) with its own staff , and the treatment costs which are the treatment fees paid to the private contractors .

The collection expenses , including street sweeping amounts to nearly 1,800 millions Bahts in 1999 , with a collection fee resource of 58 millions.

2. INSTITUTIONAL AND LEGISLATIVE FRAMEWORK

2.1. PUBLIC HEALTH ACT (PHA), 1992

In summary, sewage and solid waste management is the responsibility of local authority. Therefore, in case of waste management in Bangkok area, the waste management will be under the responsibility of BMA.

BMA has the authority to allow anyone to carry out solid waste collection business on its behalf, and also has the authority to prescribe any rules, procedure, and conditions governing the waste management in Bangkok area.

It should be noted that, with respect to the fee for collecting and hauling the waste, the local authority will have the right to charge service fee not exceeding the rate of service fee prescribed by the Ministerial Regulations (No. 2, 1993).

However, in the event that a private sector is permitted to provide the services for collecting and hauling, as well as eliminating the waste, the service fee for such services may exceed the rate of service fee prescribed by the Ministerial Regulations.

2.2. FACTORY ACT, 1992

The Factory Act mainly controls and regulates the establishment and the operation of factories in Thailand by paying attention to the impacts of factory to the environment.

Generally, factories are required under this Act to be kept clean and free from garbage and refuse at all time.

The waste elimination plant, however, will be mainly controlled by the Enhancement and Conservation of National Environmental Quality Act as described below.

2.3. PUBLIC CLEANLINESS AND ORDERLINESS ACT (PCOA), 1992

The main content of this Act is to forbid any activity that is likely to cause dirtiness to streets and public places.

2.4. ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY ACT (NEQA), 1992

There are also some rules and regulations issued in accordance with the NEQA, as follows:

2.4.1. MINISTERIAL REGULATION: # 9 (1998) ISSUED IN THE ROYAL GAZETTE DATED 25 DECEMBER 1998

This regulation controls the registration of a private organization, who wishes to engage in envi-

ronmental activities in Thailand, with the direct objectives in protecting the environment and conserving natural resources.

2.4.2. NOTIFICATION OF THE BOARD OF NATIONAL ENVIRONMENT: # 20 (2000) SUBJECT: SUB-TERRAIN WATER QUALITY STANDARD

This Regulation sets out quality standard of sub-terrain water (includes underground water), particularly the maximum density of hazardous substances allowable in sub-terrain water, which will not be danger or harmful for human consumption.

Method for collecting and keeping the samples of sub-terrain water shall be in accordance with the ordinance issued in the Royal Gazette by the Pollution Control Department.

2.4.3. NOTIFICATION OF THE MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT, ISSUED UNDER THE NEQA, AND PUBLISHED IN THE ROYAL GAZETTE DATED 7 AUGUST 1997

This Notification sets standards of effluent of waste incinerator. Under this notification: the waste incinerator shall be divided into two sizes:

- With the capacity rate of waste incineration: from 1 ton per day, but not more than 50 tons per day.
- With the capacity rate of waste incineration: more than 50 tons per day.

2.4.4. NOTIFICATION OF THE MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT #3, ISSUED UNDER THE NEQA, AND PUBLISHED IN THE ROYAL GAZETTE DATED 13 FEBRUARY 1996

This Notification sets industrial effluence standards controlled by the Pollution Control Committee (PCC).

2.4.5. NOTIFICATION OF THE MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT, RE: SPECIFYING CONDITIONS, PROCEDURES AND GUIDELINES FOR PREPARING REPORTS ON ENVIRONMENTAL IMPACT ASSESSMENT

This Notification governs the conditions, procedures, and guidelines for preparing reports on Environmental Impact

Any central waste treatment plant (as described in the Factory Act) is governed by this Notification.

It specifies that, if the waste treatment project is not required to be approved by the Thai Cabinet, the EIA reports can be submitted during the application for the establishment or the expansion of the factory.

On the other hand, if the waste treatment project is required to obtain prior approval from the Thai Cabinet, the EIA reports must be submitted prior to the filing of the request for the Thai Cabinet's approval.

2.4.6. NOTIFICATION OF THE BOARD OF NATIONAL ENVIRONMENT #10 (1992): AIR QUALITY STANDARDS

This Notification sets standards of ambient air quality in Thailand.

2.4.7. NOTIFICATION OF THE BOARD OF NATIONAL ENVIRONMENTAL #15 (1997): NOISE STANDARDS

This Notification sets standards of noise ambient in Thailand.

2.5. BMA ORDINANCE

2.5.1. BMA ORDINANCE: DISPOSAL OF GARBAGE, REFUSE AND UNCLEAN THING (1978)

Under this Ordinance:

«Garbage» means waste from paper, cloth, food, merchandise, ash, animal droppings or carcasses, including things swept from streets, market places, animal stalls, or other places.

«Refuse» means excrement or urine and shall include anything which is unclean and has foul odor.

Articles of this Ordinance are as follows:

Article 5: The person who is in possession of a premises, building, or dwelling place is required to provide garbage containers and use them to contain garbage within the premises, building or dwelling place possessed by him.

Article 8 Nopersonshalldischarge,dump,discard or create refuse or unclean things in public places or ways such as street, passage, lane,

river, canal, ditch, pond, or well, except at the places the setting up of which is permitted by the Public Health Official or the Local Official, or is specially provided.

Article 14 : No person other than the officials of BMA shall haul, scavenge, or dig garbage in garbage container, garbage hauling automobile or vessel, or at any garbage-dumping site of the BMA.

2.5.2. BMA ORDINANCE: CONTROL OF WATER SEWAGE SYSTEM (1991)

This Ordinance controls the water sewage systems in general types of buildings.

2.5.3. BMA ORDINANCE: SPECIFYING REQUIREMENTS FOR CONSTRUCTION OF BUILDING AND PUBLIC UTILITIES (1996)

This Ordinance controls the construction of building and public utilities systems in Bangkok.

2.5.4. BMA ORDINANCE: CONTROL OF WASTE COLLECTION, HAULAGE, OR ELIMINATION BUSINESS WHICH IS MADE FOR CONSIDERATION AS SERVICE FEE (1998)

This Ordinance controls the waste collection, haulage, or elimination business, which is engaged by a private sector who provides the said waste collecting, hauling or eliminating service in consideration of service fees. It requires that any person, who wishes to provide the said services, must firstly obtain a license from BMA.

The licensee shall enter into the agreements with BMA in accordance with the standard agreements drafted by BMA. It also states the obligations and responsibilities of the licensee.

2.6. THE PENAL CODE

There are some Sections in the Penal Code of Thailand, which relates to the management of waste and refuse: those are as follows:

Under Section 237 of the Penal Code of Thailand, it states that whoever introduces a poisonous substance or any other substance likely to cause injury to health into food or water in any well, pond or reservoir, and such food or water has existed or has been provided for public consump-

tion, shall be punished with imprisonment of six months to ten years and fine of one thousand to twenty thousand Baht.

Under Section 238, it states that if the offences committed according to Sections 226 to 237 causes death to the other person, the offender shall be punished with imprisonment for life or imprisonment for five to twenty years and fine of ten thousand to forty thousand Bath.

If it causes grievous bodily harm to another person, the offender shall be punished with imprisonment of one to ten years and fine of two thousand to twenty thousand Baht.

Under Section 239, its states that if the offences mentioned in Sections 226 to 237 be committed by negligence results in imminent danger to the life of the other person, the offender shall be punished with imprisonment not exceeding one year or fine not exceeding two thousand Baht, or both.

2.6.1. URBAN PLANNING ACT OF 1975 (MINISTERIAL REGULATIONS #414 (1999) URBAN PLANNING OF BANGKOK METROPOLIS)

This Regulation controls the urban planning in Bangkok area. It divides Bangkok area into Zones, and each Zone will be forbidden from engaging in different kinds of constructions or industrial activities.

The Yellow Zone is defined as Less Crowded Area, which shall be used for residential purpose, and can be used for the location of waste treatment plant.

The Green Zone is defined as Suburban and Agricultural Area, which shall be used for agricultural purpose or for governmental institutes or for public utilities.

The Blue Zone are defined as zones dedicated to public utilities and infrastructures such as waste treatment centers.

After investigation of the Zones Plan attached to this Regulation it was found out that Nong Khaem District is located in Yellow Zone and Green Zone; Prawet District (On Nuch) is located in Yellow Zone; Sai Mai District (Tha Raeng) is located in Yellow Zone; and Bang Khun Thien District (where there is a land property where BMA thinks of fur-

ther waste treatment developments) is located in Green Zone.

To allow for the construction and operation of waste treatment facilities, the site areas of Nong Khaem, Tha Raeng and On Nuch have been declared Blue zones by special administrative decision of BMA.

2.6.2. PERMISSION OF PRIVATE PARTICIPATION OR OPERATION IN GOVERNMENTAL BUSINESS ACT (1992)

This Act will control any governmental business project that has the total project value of equal to or more than 1 billion Baht. Any governmental business project, which is subject to this Act, is required to comply with the requirements of the Ministry of Finance, the Office of National Economic and Social Development Board, the Bureau of the Budget.

The authority whether to approve the governmental business project shall belong to the Thai Cabinet.

There are many decisions of the Council of States relating to this Act as follows:

The Council of States ever decided that waste elimination business shall be considered as governmental business. Therefore, if the value of the waste elimination project is equivalent to or more than 1 billion, such project will be subject to this Act.

The Council of State ever decided that, in the event the governmental agencies grant to the private sector the right to build, own and operate (BOO) the waste elimination project on the land owned by the Government (with the value of more than 1 billion Baht), such private participation shall be deemed as a private participation and operation in governmental business under this Act and shall be subject to this Act.

The Council of State ever decided that, in the event that the governmental agencies grant to the private sector the right to build, own and operate the water treatment project (with the value of more than 1 billion Baht) without having to transfer the ownership of the property to the governmental agency at the end of the agreement term, such private participation shall be deemed as a private participation and operation in govern-

mental business under this Act.

The Council of State ever decided that, in the event that the governmental agencies grant to the private sector the right to build, own and operate the project on the land owned by the Government, the value of the said land must be added to the total value of the Project.

Therefore, if the total value of the project after adding with the value of the land owned by the Government is equivalent to or more than 1 billion Baht, such project shall be subject to this Act.

2.7. OTHER LEGAL ASPECTS

2.7.1. HAZARDOUS WASTES

The law, which directly governs hazardous waste, has not yet been enacted. It is because there is no clear legal definition describing the distinction between solid waste and hazardous waste. At the moment, the Ministry of Science, Technology and Environment has the right to prescribe regulations to control storage, transportation, treatment, and disposal of hazardous waste, until the specific law governing hazardous waste is enacted.

It should be noted that there is Hazardous Substance Act of 1992, which governs hazardous substance and the used hazardous substance.

2.7.2. ORDINARY INDUSTRIAL WASTES

With respect to industrial solid waste, it is under the control of the Ministry of Industry.

At the moment, BMA has an agreement with the Ministry of Industrial Works on the management of solid waste, sewerage or refuse from industrial factories in Bangkok as well as the management of hazardous waste in Bangkok's community.

Under this agreement, the Department of Public Cleansing of BMA will be responsible for the collection of ordinary industrial wastes from the factories, while the Ministry of Industry remains responsible for the control and inspection of the management of solid waste, sewerage or refuse from industrial factories in Bangkok. On the other hand, BMA is responsible for the collection of hazardous waste from community and transfer to hazardous waste disposal site or other place as designated by the Ministry of Industry.

2.7.3. STATUS OF THE LANDFILL SITES AS INDUSTRIAL SITES

The Ministry of Industry (Mol) is still having a problem of the definition of Landfill sites whether it should be considered as a type of central waste treatment plant, and whether it should be required to make a report on the Environmental Impact Assessment.

However, the Ministry of Industry ever decides that the Landfill is not an industry, but as this kind of industry has not yet been stated elsewhere, it is necessary to increase types of industrial business to cover the landfill according to the Factory Act (1992), which is right now under consideration for amending the Ministerial Regulations.

2.7.4. BUILDING CONTROL ACT

There is the Building Control Act of 1979, which controls the design, construction, renovation, remove and utilization of the building. The construction of waste treatment plant shall be considered as the construction of the building under this Act.

3. PROPOSED TIME HORIZON RELATED STRATEGY

The treatment plants will be located at the sites of Nong Khaem, Tha Raeng and On Nuch, which are owned by BMA and where land availability is sufficient for the requirements of the industrial units.

3.1. SHORT TERM SCENARIO

3.1.1. COMPOSTING

A 1,000-ton capacity composting plant is advisable in the short term at On Nuch by completing the revamped existing plant with the necessary installations in terms of pre-treatment of the wastes, composting and maturation hall, and air treatment. Compost produced will be available for farming units to the east of Bangkok Metropolis.

3.1.2. METHANISATION

Methanisation plants could be installed in Nong Khaem under two different recovery schemes with a total capacity of 1,000 ton per day:

- Production of electricity and heat;
- Production of collection vehicles fuels.

While the electricity of the first unit would be sold to Metropolitan Electricity Authority (MEA) grid, with a tariff made attractive by the incentive from National Energy Policy Office (NEPO), the heat produced could be used for the operation of the wastewater treatment plant under construction. The second unit would provide fuels for 135 trucks, on the basis of the existing composition of waste, with a significant environmental benefit to the urban traffic.

3.1.3. RECYCLING

Process of recycling complements the bio-treatment process on the same site as the recoverable materials are included in the rejects from the pre treatment upstream of methanisation process.

RECOVERY LEVELS

Year	2000		2005		2010		2015		2020	
Process	%	t/day	%	t/day	%	t/day	%	t/day	%	t/day
Recycling *	0%	-	10%	1 030	10%	1 166	10%	1 319	10%	1 421
Composting	0%	-	10%	1 000	10%	1 200	10%	1 400	20%	2 900
Digestion	0%	-	10%	1 000	10%	1 200	10%	1 400	20%	2 900
Incineration	0%	-	15%	1 500	15%	1 500	15%	2 000	15%	2 000
Landfill	100%	9 000	55%	5 772	55%	6 591	55%	7 069	35%	4 987
Total	100%	9 000	100%	10 302	100%	11 656	100%	13 188	100%	14 207

* Recycling before transfer station n/a for in the table

Recycling is done in the short term, through a sorting centre in 2005 in Nong Khaem on 1000 tons per day shared in common with the methanisation process.

3.2. MEDIUM AND LONG TERM SCENARI

The medium and long term scenari could include:

- Extension of the capacity of composting at On Nuch in years 2010/2015;
- Creation of capacity of methanisation at Tha Raeng in years 2010/2015;
- Construction of a 1500 tons/day of methanisation at On Nuch in year 2020.
- Construction of a 1500 tons/day of composting at Nong Khaem in year 2020. ■





Roles of the Public in Waste Management in Bangkok City

Benjamas Chotthong

Thailand Environment Institute

Introduction

The increasing problems of waste in Bangkok City came to pass in 1997 when the metropolitan area of Bangkok could no longer sustain and manage the amount of waste generated in the area. The Bangkok Metropolitan Administration (BMA) sought for solutions by transferring the city's waste to landfills located in its vicinity namely Ampohe Kham Phaeng Saeon in Nakorn Phatom Province and Amphoe Bang Plee in Samut Prakarn Province. Despite BMA's endeavor to tackle waste problems through the use of modern technologies such as incinerators, some of its projects neglected public participation, thereby creating discrepancies and conflicts from the public. One example could be the dispute between the communities and the Racha Thewa Waste Disposal Project in Amphoe Bang Plee, which retains 350,000 cubic meters of waste per day on a 250-rai of land.

Public participation in Bangkok's waste management has, however, existed for many years, but in the form of small groups scattered throughout the city. These groups haven't enough networking and mechanism to help expand the results and bring their initiatives to a scale corresponding to the rapidly growing city and the enormous amount of waste generated. NGOs and social service organizations had mainly roles to advocacy campaigns, pilot activities and strengthening community-based activities as well. They emphasize more in coordinating with others partnership especially government.

Taking a step forward into the 21st century toward becoming a «Sustainable City», Bangkok will need to recognize the importance of collaboration between various stakeholders as well as the importance of public participation. It is also essential to integrate the waste management of city with other pertinent factors.

Abstract

The continued accumulation of waste within Bangkok City is reaching proportions beyond the current waste management capability of the city. The Bangkok Metropolitan Administration (BMA) has applied solutions such as transferring the city's waste to landfills located in its vicinity. BMA has also been gathering information on technological solutions, such the use of incinerators, but these methods have not gained the understanding or acceptance of the local population. Further, some of the mega projects such Rachathewa landfill plant which affect the local communities, have failed to include them in the decision making process, thus ignoring their right to participation and as a result causing problems of non-acceptance and protests.

Citizens of Bangkok have actually for a long time already been participating in waste management issues in Bangkok City, but on a small and scattered scale. It lacks networking to allow for an expansion on par with the rapid development of the city, with the related increased waste accumulation leaping far ahead. Recent activities include



projects by non-governmental organizations and public agencies, with most of them being in the form of public awareness campaigns or activities. Unfortunately the expansion of such projects, or efforts towards improved policies and strategies for the public sector are still few.

The aim of Bangkok City, to become a «Sustainable City» of the 21st Century, largely depends on the importance attached to the cooperation of existing stakeholders, to public participation, and the attention paid to waste management, which concerns everyone and which is an essential part of effective urban management.

Important issues for effective waste management in Bangkok City

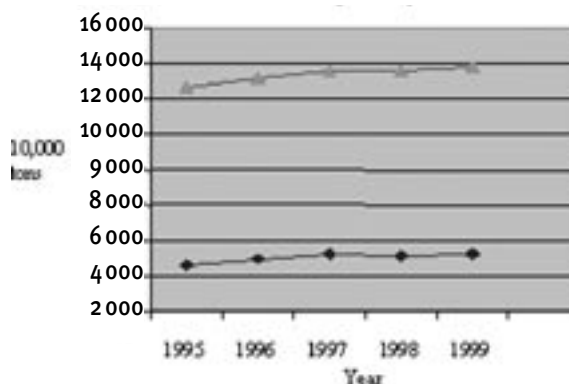
Waste management in big cities such as Bangkok is a challenge not only for urban managers, but also for the people who live there, because they are the ones who will have to face the problems without being able to avoid them. At present, some changes in the waste problem can be noticed, apart from the increasing amount, such as the changed composition of the waste, including components that have more severe effects on the environment and eventually on the quality of life. A basic factor causing the increasing amount of waste is the increasing amount of waste producers, both dwellers and traders, increasing the consumption per capita and the activities.

The severe impacts of the economic crisis in the year of 1997 could be felt all over Thailand. However, the crisis actually also had a positive affect on Bangkok, the only mega city of Thailand, as it resulted in decreased waste accumulation, and increased separation of waste and increased collection for recycling.

The amount of Bangkok city's waste

Year	Amount of waste (ton/year)	Change Rate(%)
1995	2,626,024	-
1996	2,955,970	12.5
1997	3,266,386	10.5
1998	3,102,500	- 5.0
1999	3,281,350	5.8

Source: Pollution Control Department, 2000



The decreasing rate of city waste in the economic crisis period implies decreasing of urban migrants, solid wastes were separated, and changes in consumer behavior as well. However, behavioral changes in consumption have also had a direct impact on the changes in the components of the waste. In the past, much of the waste from consumption was composed of degradable components that could be turned into fertilizers favoring the environment. At present, with the changes in the consumption patterns, people have turned towards consuming packaged products resulting in more wrapping and disposable single use waste. To mention just one example, disposable diapers now substitute washable and reusable diapers made of cloth.

An important factor for improved waste management is the awareness and understanding of the people, which can be divided into two parts as follows:

1) Consumer awareness, or in other words changing the patterns of consumption to achieve a

minimum amount of waste, by increasing the knowledge about reusable materials, recycling, and how to make fertilizers from degradable waste in order to reduce the original amount of waste. Present public relations campaigns through media have not been successful in widely changing the behavior within households.

2) The knowledge and understanding on the waste management system of the city, such as the separation of non-degradable and hazardous waste components, how to dispose of hazardous waste, and others related information on waste management within Bangkok. This requires education of the public for a better understanding and improved cooperation. Recent public relations campaigns on waste separation have actually been quite successful, but people still lack an understanding of and confidence in what the city will do after the waste is separated, claiming that the separated waste will be dumped together as before, resulting in criticism and reduced cooperation. Therefore, measures to enhance the awareness and knowledge of the people need to be carried through at all levels.

Access to information is considered very important in creating a better understanding and is in direct relationship with people's participation. The current Constitution of the Kingdom of Thailand declares the rights and responsibilities of the people within the development process of the country, and confirms their right to participate in governmental programs, starting from the planning and decision making processes and throughout the implementation and follow up stages. However, on-going projects that were planned before, but with the implementation phase starting after the execution of the new constitution, these are projects that have faced protests from the people.

Still, these protests occur only among the directly affected populations. For example, one such conflict was with the community near the Rachathewa solid waste management project, located in Samut Prakarn District within the vicinity of Bangkok, a project with the objective to construct a municipal solid waste (MSW) management facility to dispose the waste from the On-nuch plant.

Since December 1998, a private company has been responsible for the management of the 200 rais plot used for sanitary landfill of waste 3,500 tons/day. The odor from the waste disposal site is affecting six villages of about a total of 2,500 houses. Views expressed by academics and private development agencies claims that the government is violating the rights of the people. There is a lack of understanding between the Bangkok Metropolitan Administration, the private companies involved and people concerned.

Results from surveys of the attitudes and of the participation of citizens of Bangkok in solid waste management issues of Bangkok City (TEI, 2001) showed the following:

1) Although there are continued public awareness campaigns and activities on solid waste disposal issues, including separation and correct disposal locations, waste disposal behavior of the people remains to be guided in the right direction.

2) The people still lack confidence in the units and agencies that are responsible for the waste disposal management, doubting whether they actually will carry through the solid waste separation process.

3) Many still refuse to accept the incinerator technology for getting rid of the waste, due to a lack of understanding of and confidence in the efficiency, operation and maintenance of the incinerators.

Roles of non-governmental organizations and the public

While encouraging non-governmental organizations (NGOs) and the public to participate in the management of the natural resources and the environment for the sustainable development of the country and to the point where it is included in the present Constitution (since 1997), there is a simultaneous need to recognize the fact that NGOs and the public have played an participatory role already for quite some time.

In terms of solid waste management in Bangkok NGOs have played a continued role with examples such as the Environmental and Community Development Association, the Media Center for Development Foundation, the Thailand Environmental Institute, the Anti Air Pollution and Environment Protection Foundation, the Green World Foundation, the Duang Pratheep Foundation, and the Urban Community Foundation. The activities have been in areas such as:

- Providing information on waste management and correct waste disposal methods
- Arranging awareness campaigns for waste separation and recycling
- Encouraging the establishment of long term strategies
- Research
- Strengthening the knowledge of the people in an effort to improve their waste handling management.
- Coordination with the public sector with an aim to achieve policy changes

Case 1: Recycle Paper for Trees

One project, recycled paper for trees, conducted by an NGO, aims to reduce waste through a way of thinking that says: «reduce waste, preserve trees with scraps of office paper». This strategy encourages a more efficient use and correct disposal of paper. The project includes useful paper processing information, such as on raw materials, production, the impact of paper production on the environment, and implementation of the recycling process. They point out the importance of a wise use of paper, through the example that the recycling of 30 sheets/day will help save one ton of trees per year.

This on-going project has been managed by the Media Center for Development Foundation since 1998. It emphasizes on the cooperation between the public and the private sector, and educational institutions in and around Bangkok, with paper using offices. This starts with awareness creation activities, placing donation boxes for used papers



(both sides), collecting the boxes as scheduled or when reported. After collection, the paper is forwarded for recycling. The income earned is entered into a fund for «paper for trees», to support the conservation and rehabilitation of natural resources with additional funding support from private development organizations and rural communities that work in the fields of forest and water conservation.

Case 2: Magic Eyes

Magic Eyes is a well-known logo of the Thai Environmental and Community Development Association (TECDA) since more than 10 years back. Starting with a campaign against littering, this lead to other activities related to waste reduction. Activities of the Association include: encouraging the use of natural materials instead of polystyrene substance in the floats during the Loy Kratong Traditional Festivals; waste separation information campaigns, especially for paper and glass waste; arranging environmental camps for youth, having a «Magic Eyes Ambassador» to act as a young presenter, encouraging role plays for children.

TECDA is a potential actor in coordinating and encouraging support from both the public and the private sector and the press, having 26 private business organizations as members. Most of these organizations are important both on a

national and an international level. Among them notably are five television stations, which equals 83% of the existing national television coverage (with the exclusion of satellite stations). This facilitates the dissemination of information and provides broadcasting opportunities for the public awareness activities of the association.

Case 3: Developing occupational skills for the collection and buying of used products Project



People with an occupation of collecting and buying used products means: (1) People who collect waste for a living, commonly known as «Sa-Leng», a three-wheel vehicle for collecting waste. These people act as a center for collecting and separating waste, buying waste from private homes, stores, and other places and then selling it to (2) stores that buy waste, acting as retailers responsible for gathering waste before sending it on to factories for processing. Both groups of people have roles in reducing the waste in Bangkok with an estimated 400-500 tons/day, or an average of

and the benefits of skilled knowledge obtained through training are also clear. The activities of this program include seminars and handing out of manuals on waste management, providing knowledge about toxic waste, providing information about health and safety issues, maintenance of their three wheeled vehicles, the «sa-leng», some of which are motorized, some pedaled. Other methods for developing the necessary skills for this kind of occupation include systematic arrangements and registration for licenses,

4.5-5.5% of the total amount of waste of about 9000 tons/day, and averaging 12-15% of the total waste that could be brought to the recycling process. An additional group of people assisting in the separation of the waste is the waste collection employees or workers in Bangkok, who not only collect but also separate the waste.

As for the stores that buy waste or used products in Bangkok, there are 1,145 licensed stores (data of 1996). However, there are additional stores that have not registered for a license in order to avoid taxes.

This project to develop occupational skills for the collection and buying of used products is conducted in cooperation between the Department of Environmental Quality and Promotion (DEQP) and Thailand Environment Institute. The importance of this group within the waste management process is clear. At present, without training and systematic management support, they are still at risk,

which also encourages more systematic working methods. Further issues are marketing support, building networks and funding support. The success of the project depends on the cooperation of all parties involved, including the different responsible units of the public sector in Bangkok, the DEQP and the Ministry of Public Health.



reduction in the community, advocating the value of using resources wisely, and in supporting the linking up and in the creation of relationships between communities.

In addition to being a waste problem solving strategy, by buying waste from the community for recycling, the Community Waste Bank also provides an income earning opportunity for the community. The services are provided on a weekly basis, or more often depending on the need of the community. Most of the activities of the Community Waste Bank are focussed on the young, with benefits extending to their families. Each child will have a savings book with the Community Waste Bank, and when the waste is brought to be sold at the bank, they will receive a money transfer into their accounts that can be withdrawn as well.

Case 4: Community Waste Bank

The Community Waste Bank is an activity established by an NGO that works in a poor community in Bangkok. At present, the activity is expanding into a wider community, with knowledge sharing and the establishing of connections among the communities, with the NGOs playing only a consulting role. The activities of the Community Waste Bank are important in providing knowledge about waste separation and waste

In some areas the cooperation between communities has been further developed, such as for example through the center for recycling set up by the network of the Bangkapi community to buy waste from the Community Waste Bank and from other nearby communities, including buying waste from outside sources. The recycling center is managed by representatives of the community network committee.

At present, the activities of the non-governmental





organizations and the local communities still depend on government and international funding, such as from the Pollution Control Department, the Department of Environmental Quality and Promotion (DEQP), the National Energy Policy Office, the Social Investment Funds, private business agencies, and the Danish Cooperation for Environment and Development (DANCED). The support received is for short-term projects of up to three years, which affects the form and continuation of the activities that would benefit from more long-term commitments. Through building up the knowledge and awareness of the people to enable them to bring about changes in their consumer behavior patterns, this will also result in strategic changes in the structural levels of waste management.

Steps Towards Improved Waste Management Systems in Bangkok for the 21st Century

During the Eighth National Economic and Social Development Plan period (1997-2001), better management of the city environment was brought into focus along with other relating factors to establish a balance between developing the society, the economy, and the environment under the motto, «Sustainable City...Sustainable Community». At present, this approach has received encouragement from the National Economic and Social Development Board, requesting for expansion and immediate implementation. The public sector will play a role in supporting and encouraging the participation of the people in the development of the city, starting with the establishment of community plans. The goal is to make the city and the local communities stronger and a more pleasant

and cleaner place to live in.

Waste management, which relates to other factors within the development process, should be taken into consideration in relation to these. The example of the Community Waste Bank clarifies three aspects of these relationships, the social aspects that can be seen in the community participation, the environmental aspects in helping to reduce waste and creating a better environment for the community, and the economical aspects of increased income opportunities for the people in the community. However, other activities are also important, such as campaigns, research and establishing waste management techniques for more efficient waste management. For a successful waste management system, able to keep up to date with the complex changes of the city adjusting roles are necessary, and cannot be achieved without the participation and cooperation of NGOs and the public due to limited budget and personnel of the Bangkok City. However to avoid confusion and overlapping of activities close cooperation between all parties is necessary, including a full understanding of the social aspects involved. This depends on the support from the public sector where the final responsibility is, that is, Bangkok City, and the support from other concerned public agencies.

The 21st Century, an era of Information Technology and unlimited cooperation provides an opportunity for spreading information, extending the learning process, and building cooperation between the people, the public sector, private business agencies, NGOs, and academic institutions in the country, and extending into international cooperation. All this depends on those who run the city of Bangkok in terms of whether

they can see the importance of public participation and the importance of all stakeholders as mentioned earlier. And whether they have a clear understanding of «Waste Management in the City is Everyone’s Business». ■



Appendix 1

Thailand Environment Institute

Mission

- by conducting research activities to benefit the conservation of natural resources and the environment, and by supporting and participating in the practical application of the research findings.
- by establishing up-to-date and reliable information systems and through providing for extensive dissemination of quality information on environmental issues.o by developing and enhancing the knowledge and capabilities of the staff so that they can be proud of their work and their organization.
- by producing quality research publications to be made available to relevant institutions and the general public, both locally and internationally.

Grassroots Action Program

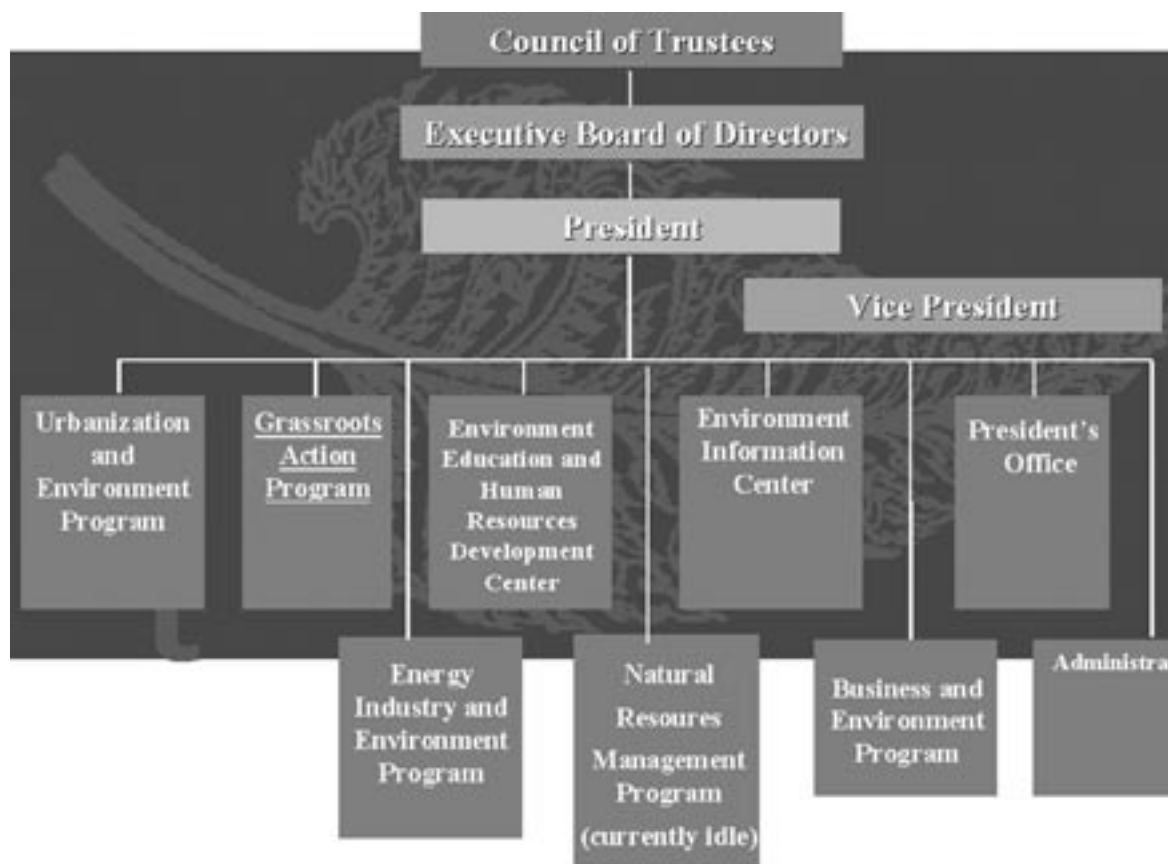
- Sustainable Forest Management
- Sustainable City
- Urban Forestry
- Urban Environmental Management
- Capacity Building for Decentralization
- Community-Schools Partnership for Environmental Management
- GO, NGOs and CBOs Environmental and Natural Resources Networking
- Community Based Sustainable Tourism



Appendix 2

Thailand Environment Institute

Structure







Bangkok

Discussion

Introduction

Ms. Lye Lin Heng

You can see that the situation of handling waste management is quite different in the two countries. I think that what is very clear is that people are not allowed in the landfills in Hong Kong and it is otherwise in Bangkok. I visited a landfill in Thailand when I was teaching at the Asian Institute of Technology and I also visited an incineration facility. There is actually a law, article 14 of the Bangkok Metropolitan Authority (BMA) Ordinance on the Disposal of Garbage and Refuse, 1978, that prohibits any person (other than the officials of BMA) from hauling, scavenging or digging garbage in any garbage container, garbage hauling automobile or vessel, or at any garbage dumping site of eh BMA. However, it does not seem that this law is enforced.

Are there any controls, any effort to provide a proper system, particularly in view of the health hazards and the fact that small children are running around and they have to dodge the vehicles bringing the waste? Can you explain a little more about the scavenging problem?

On the question of recycling, it appears that Thailand has a pretty good system in place and the NGOs are making considerable efforts towards recycling. I was particularly impressed, looking at Thai laws, to see they actually have laws that provide for the recognition of environmental NGOs. NGOs that are registered with the government are entitled to assistance; they can apply to the government for funding, etc...

About scavenging

Michel Valin

Comment on the scavenging: A few weeks ago, I was discussing with the people in charge of the transfer site management and it is true there are plenty of people scavenging just in the transfer site. When the collection trucks arrive at the transfer site, they are not unloaded directly into the big trucks. They first unload on the pavement and you have dozens of people trying to scavenge, to continue the informal recycling process. Afterward, they load again the garbage and put it on the trucks. In fact, they work 50% outside the transfer station, in the compound. It is a huge waste of time.

Question to Mrs. Chotthong: What are your social interventions with the scavengers in the transfer centers?

Benjamas Chotthong

Our institute produced a booklet to teach them how to deal with hazardous toxic waste. But actually they are just squatting the land there; the land does not belong to them.

Nola-Kate Seymoar

I would like to add a comment because a lot of what the T.E.I are doing in Thailand is similar to what we did with them. If we do not allow scavengers and middlemen, and we look down on them and say they are not part of the waste cycle, we then invest our money in high-technology solutions from developed countries. It is great from a Canadian point of view, Edmonton has a very expensive system when you do not need to sort things and we solved the waste

problem. That is not effective in the communities we are working with. In the Philippines, for example, what we are doing is that the waste pickers we are dealing with in terms of functional literacy programs or teaching them how to do electronic repairs; we now have built a one-room school for the children on the dumpsite. They are learning English, they have seamstress training, they get medical missions, they have market gardens. We are now farming pigs with them and they build up the capital. After 3 rounds of raising the pigs, the pig then becomes their own. I know these programs are a drop in the bucket, but they are dealing with the reality in that city with the waste pickers. But that can be done elsewhere, and with the junkers forming co-operatives, developing micro-credit schemes, they are small business. What I worry about is the orientation we have that says: let's do it a different way and have a technological solution that puts more people out of work.

Michel Valin

Of course, the social aspect of the problem for sorting or recycling in the informal sector is a serious important issue. We discussed this at the beginning of our study with the BMA and the Cleansing Department and we had a full scope of work in our study. We have chosen to focus on the intermediate treatment aspect for several reasons: the most important problem is to eliminate the waste in a safe environmental way, which is the main issue. We could imagine, some optimization of the waste transfer project by using the workforce but in a more industrial manner. This is also integrated in our proposal, i.e., more industrialized and safer manners.

The last aspect of the waste management is the landfill disposal. Of course, in a landfill area, even though it is a private area, you have many people waiting for sorting the garbage. It is important to keep the social aspect in mind for any other solutions. What we propose to BMA, is an intermediate option, where the poor people do not suffer from the technology.

Technical aspects of waste management in Bangkok.

Ms. Lye Lin Heng

Paper recycling: I would really like to know if it is ecologically, environmentally sustainable to recycle paper, because as a layman, my understanding is that we used to think that we should always recycle paper, but it is also environmentally damaging because you have to bleach it to get rid of the ink and that causes pollution. It may be better to just grow some species of trees, which grow very quickly and provide a lot of timber. It might be cleaner in the long run.

The proposed target is that by the year 2020, you have something like 20% composting, and 20% of methanization. One of the problems of composting in Thailand was the mix of organic waste (plastic, glass...). It is important to separate organic material from other waste before they can be composted. This is quite a high percentage; I am not sure how you do the source separation of the organic waste?

If you've got 9000 tons per day of waste collected in Bangkok Metropolitan Area, covering about 8 million people, is everybody serviced or is it only a proportion of that? In some places, they can do only 80%. If that is the case, then the per capita waste generation is quite high.

Michel Valin

Concerning recycling it is important to say that there are opportunities for specific companies to install, set up units at the transfer site. We have an example in Oun Nuch, there is the Tetrapak Company. They have implemented a small unit to get the papers and to produce materials for their products. It is a brand new production plant but it works.

The experience with the former foreign contractor, who tried to run the operating system in the composting plant in On-Nuch failed. One of the reasons of this failure is that they had a lot of rejects, much more rejects than they had assumed in the beginning. The second reason was the quality of the compost, because according to what we

understood, they had a lot of debris of glass in the compost, and they received a lot of complaints from the farmers. These latter stopped buying the compost from the plant.

Manfred Giggacher

I think that you mentioned there was a medical incinerator. Going from past experience, medical incinerators are normally unclean. What type of incineration technology were you referring to in your presentation? Because if you think about old technologies, and you are incinerating medical waste, you are creating a health hazard in the air. So, what type of technology are we talking about now in Bangkok?

Michel Valin

For the new technology, I was speaking about incinerators to treat all waste. It is a proposal by the Japanese. There are a lot of questions from the Thai administration, aside of the investment cost. Some questions are concerning the residual pollution from the incinerator.

Concerning the incineration of the biological waste in On-Nuch, they have two ovens and this technology was provided by an Australian company. Of course, it is not properly operated and we have noticed that the temperature is lower than the requirements in the control room.

Ms. Lye Lin Heng

I know that in the Philippines, the NGOs have managed to compel the passing of a law that bans incineration. That is being reviewed. Among Environmental groups, there seems to be a misunderstanding that incinerators are very bad. With regard to methanization, is there any Asian country that has started this system?

Michel Valin

Thailand just raised this issue very recently because we think that a part of the composting process, biomethanization, we produce compost and biogas. So we recover the energy, this is the main advan-

tage compared to the composting system. In addition to producing compost, we recover some energy by means of producing gas, heat, vapor... This energy can be used in the vicinity of the plant to deliver energy in form of vapor or electricity for local industry, or recycling industry. ■

