

# MUNICIPAL SOLID WASTE MANAGEMENT IN THE MUNICIPALITY OF LAEM CHABANG- OVERVIEW OF EXISTING SYSTEMS

David T. Brown\*

Kashane Chalermwat\*\*

Siri Siripunkaw\*\*\*

## Description of Solid Waste Collection System in Laem Chabang

In Laem Chabang, commingled municipal wastes are picked up on a daily basis from all households, retail/commercial operations, and institutions. Nonhazardous industrial wastes are also collected by municipal crews. Retail/commercial wastes (e.g., from marketplace and shopping areas) are placed in centrally located dumpster containers.

### Organisation of employees

The organisational structure for the Environment and Health Department of the Municipality of Laem Chabang, a crew of 55 men collects refuse from motorized collection vehicles, and an additional 52 street sweepers (14 men, 48 women) clear refuse from roads, sidewalks, and other public places. Collection and sweeping staff are employed on a contract basis.

The operational unit for waste pickup is the 5-man truck crew, consisting of one driver and four collectors. Trucks vary in size, design, and ease of operation. The municipality currently owns 11 collection vehicles: 2 long box Toyota Hilux Pickups outfitted with side access bins, 4 Mitsubishi Diesel toploaders, 2 Mitsubishi Diesel rolloff container trucks, 2 Mitsubishi Diesel end-load packer trucks, and one Mitsubishi flatbed truck used for waste collection.

### Work schedules

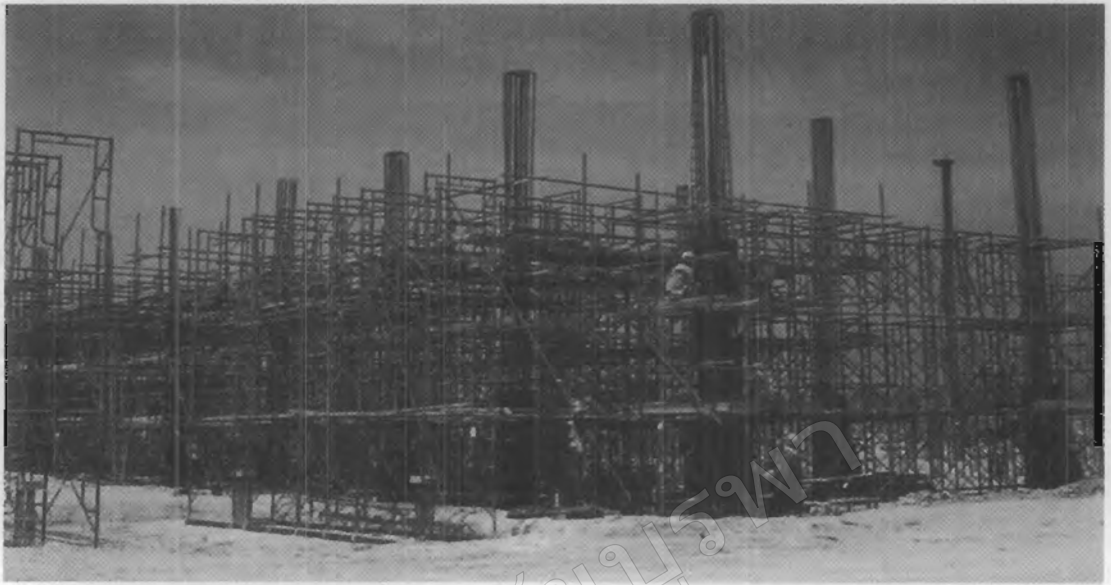
Shifts begin in the early morning (3-4 a.m.) every day except Sunday. Each crew follows the same route every day for a period of about weeks, whereupon routes are rotated amongst truck crews. This avoids monotony, and evens out the economic opportunities for waste recovery, since certain routes are more lucrative than others (e.g., through industrial estates). Crew members earn a weekly salary of

\*Environmental Policy Institute, Brock University, St. Catharines, Ontario, Canada L2S 3A1

\*\*Department of Aquatic Sciences, Burapha University, BangSean, Chonburi, Thailand

\*\*\*Dept. of Geography, Burapha University, BangSane, Chonburi, Thailand

DRAFT COPY-29 July 1994-Based on interviews conducted on Wednesday, July 20, 1994, and observation run on Friday, 22 July, 1994



3000 baht (collectors) or 3450 baht (driver). Shifts are 8-12 hours in duration, depending upon the amount of time required to fill the truck and make the trip to the dump. Monday through Wednesday, the crew makes three complete round trips to the dump. Thursday through Saturday, only two round trips are made. Sunday is a holiday.

After wastes are placed into metal curbside containers by residents, some degree of source separation is accomplished by itinerant waste pickers who travel through the neighbourhood recovering the more valuable salable commodities. Waste recovery by this sector occurs before municipal collection personnel are able to pick up the wastes.

Street sweepers are equipped with brooms and shovels, placing refuse in waste drums located throughout the municipality. The opportunities for waste recovery by this group of workers is limited.

#### ***The collection process***

Crews begin their fixed routes and continue to load refuse into the truck until it is full to capacity. Garbage is picked up primarily from the 800 curbside receptacles supplied by the municipality (mostly 200

1 metal drums, with some 150 l plastic barrels and occasional cutdown 100 l metal drums, bamboo baskets, tire baskets, or other containers). Drums are spaced out along the roadside to serve the needs of adjacent residents, with multiple drums being provided in areas of high population density (e.g., apartments, condominium complexes, or rental housing developments). Large industrial, commercial, and institutional operations may be equipped with municipally-owned (10) or privately-owned (7) waste containers, which are collected and emptied by the municipality.

Residents take their garbage out to curbside drums as needed. Each drum or set of drums serves a relatively constant group of adjacent residents, but access to drums in neither formally assigned nor controlled. Rural residences may have one drum per household, but pickup in sparsely populated or low waste generation areas may only take place on alternate days.

Waste drums are emptied into the toploader or packer trucks. On toploaders, two crew members stay on the truck and two jump off. Those on

the ground lift the heavy metal drums upwards, assisted by the crew members on the top of the truck. This is necessary, as the liftover height on the trucks is about two metres above the ground. Two sets of metal handles are welded onto the side of the drums, one set near the top and another near the bottom, to provide grip for the crew members. The drum is emptied, then passed back down to the crew members on the ground, who return it to its original position at the roadside. Packer trucks are loaded at the rear by pairs of employees emptying waste drums. Containers are picked up by specially outfitted mechanized container rolloff trucks and hauled to the dumpsite.

Metal drums have a useful lifespan of about 3 months before they have to be replaced due to damage or corrosion. The Thai petrochemical industry currently provides these drums free of charge.

#### ***Preliminary sorting of recoverable***

Municipal personnel conduct their own informal sorting and recovery operation on the commingled wastes, both during the collection process and afterwards at or near the dumpsite. Sale of these materials provides a significant source of revenue to the employees.

During collection, crew members sort refuse into preliminary categories, picking out recoverables and placing them into: a) large plastic bags within or on top of the truck (e.g., bottles), or b) into loosely differentiated piles in the back of the truck (e.g., corrugated cardboard). On sparsely settled sections of the route where pickups are farther apart, crews take advantage of the brief travel time between stops to continue their sorting activities in the back of the moving vehicle.

#### ***Sorting and upgrading at the dumpsite***

The role of the municipal crew:- When fully loaded, the truck is driven to the 35 rai (5.8 ha) dumpsite in Nong Glang Dong (an agricultural district in the north-central section of the municipality). This unimproved interim site, established in May of 1994, has a projected lifespan of five years. Prior to 1994, refuse was sent to the Sri Ra Sha municipal dumpsite, where a 10 rai (1.7 ha) section was leased by Laem Chabang.

The first stop at the dump is at the sorting area, where further sorting and waste upgrading occurs. Recoverable materials are removed from the trucks by hand, sorted into homogenous categories, and undesirable contaminants are removed. Contents are dumped from partially empty bottles. Corrugated cardboard boxes are flattened and baled, and nylon rope or wire is coiled and bound. Some articles are sold on a unit basis for washing and reuse (e.g., certain bottles or containers), whereas others are sorted by material type and sold by weight for recycling (e.g., ferrous metal scrap, clear glass). Upgrading entails some processing of wastes (e.g., burning the insulation off scrap copper wire to increase its value and reduce the volume of the economically valuable fraction).

Each crew has its own storage area for the saleable commodities it recovers from the waste stream. Materials are kept there in piles, bags, or drums until a waste broker arrives to purchase them, usually once week.

The role of the resident waste pickers at the dumpsite:- After recoverables are removed from the truck, the remaining refuse is taken to the dump itself, an unlined hole 0.5 rai (185m) in diameter excavated in a former tapioca field, where it is dumped out of the back of the truck. A family of 9 resident waste

pickers sorts through the waste with rakes, removing any remaining items with economic or utilitarian value and levelling the piles.

This second tier of waste recovery is a more time-consuming and labor-intensive process than the preliminary separation undertaken by the municipal crews. At the Nong Glang Dong dumpsite, a family of nine individuals works 10-12 hours per day to process the incoming wastes.

#### **Volume Estimates and Composition of Municipal Solid Waste**

Data on total volumes of MSW are maintained by the municipality. However, no formal data has been collected on waste composition or per capita waste generation. Municipal officials estimated that some 60% of the material by volume consists of putrescible and organic wastes, generally quite high in water content. JICA (the Japan International Cooperation Agency) has estimated that per capita MSW generation is approximately 0.8 kg/day in similar Asian cities (Kusuma Wongjantara, pers. comm.).

A sampling program has been proposed to address some of the data needs.

#### **Current MSW Management Policy and Funding Arrangements**

Waste management policy throughout the Kingdom of Thailand is centrally developed and administered by the Ministry of the Interior in Bangkok. Waste collection protocol and longterm capital expenditures on waste management infrastructure are also determined centrally after consultation with the municipality, by the Department of Local Administration and the Department of Public Works. A sanitary landfill facility has been mandated for Laem Chabang as the major means for municipal waste disposal. This proposal is opposed by the Mayor of Laem Chabang, who would prefer to see the funds used to develop and administer a more integrated system of solid waste management which encompasses a wider range of options for waste reduction, reuse, and recycling.

Tax revenues in the municipality are collected



by Bangkok, and transfer payments are then made back to the municipality by national officials. Only 2% of collected tax revenues are returned by the central administration to the municipality of Laem Chabang. This results in a situation of chronic underfunding which affects all aspects of municipal governance and operation, including solid waste management. Waste collection expenses in Laem Chabang total approximately \$6 million baht per year, but only \$1.5 million baht are received in transfer payments from the central administration. Thus, only 25% of the actual costs of waste management are covered by operating funds from the central administration (Boonlert Normsil, pers. comm.).

This situation of chronic underfunding has caused the municipality to consider alternative waste management strategies which have the potential to generate income. Some municipal officials, conscious of the revenue potential of recyclables separated from the solid waste stream, are interested in

exploring the possibility of formalizing the collection, sorting, and marketing of recyclable commodities as part of the municipal mandate. This has obvious ramifications with regard to the informal waste economy and the activities of indigenous and itinerant waste scavengers, and raises the now-familiar debate on the economics, sustainability, and social equity issues surrounding waste picking (Furedy 1989).

The Mayor of Laem Chabang also expressed interest in using municipal waste management as a high-profile political issue designed to encourage transfer payment increases to the municipality from Bangkok.

#### *Initial Proposal and Suggestions for Waste Management Research and Education Discussed With Municipal Staff*

Municipal staff members had a number of ideas for programs to improve the waste management infrastructure and process in Laem Chabang, though none of these have been developed or formally implemented to date. Ideas discussed included:

##### *Wet/Dry MSW Separation Program*

Since some 60% of the waste stream consists of putrescible organics, municipal officials would like to see a voluntary citizen participation program where wet and dry MSW components are source separated by householders. This would facilitate the later sorting of recyclables for revenue generation.

The Mayor proposed a two-bag pilot program in the Ao-udom and Ban Toung subdistricts of the municipality. The municipality would provide householders with two types of colour coded plastic bags: black bags for the "wet" stream (putrescible organic wastes) and gray bags for the "dry" stream (recyclables and other dry waste materials). Such



separation would greatly facilitate the manual sorting and recovery of recyclables with economic value, the Mayor's main rationale for the program. This approach would also be useful to divert organics to a municipal composting operation, if contamination of the wet stream by other debris could be kept at acceptable levels.

Such an initiative would require a publicity campaign and clear instructions to municipal residents about waste separation protocol. An information brochure was proposed for distribution within the study area along with the coloured bags.

#### ***Waste Composition and Per Capita Waste Generation Study***

Integrated waste management planning requires baseline data on per capita waste generation and accurate estimates of MSW composition. Municipal officials were very interested in gaining insight into these areas, and a number of strategies for data collection were discussed.

Since waste is collected on a daily basis (or at most once every two days), it would be possible to use the two-bag wet-dry pilot program as a preliminary data collection tool. Bags supplied to participating householders could be identified by marking them with identifying codes. Questionnaires administered concurrently to householders could be used to gain information about number of residents, income levels, occupations, and other relevant demographic/ socioeconomic parameters. At the time of pickup, bags of source-separated wet and dry garbage from these households would be weighed and measured for volume, and the "dry" stream would be further analyzed for composition according to protocol adapted from the Ontario Waste Composition Study.

Depending upon the number of households in the study area, the dwelling type, and the demographic and socioeconomic parameters of the residents, a sampling strategy could be designed which might provide waste generation and composition data representative of the entire community. Analysis of data from this pilot study would contribute to the development of a standardized sampling protocol, which could be generalized to the rest of the municipality or to other municipalities in the province.

#### **THE INFORMAL WASTE ECONOMY IN LAEM CHABANG**

There are several discrete groups of waste pickers active in the Laem Chabang informal waste economy. These include: 1) householders who practice some form of source separation themselves, such as saving newspapers to sell to waste paper brokers; 2) itinerant waste pickers, local residents or squatters who pick wastes from the disposal drums prior to their collection by municipal crews; 3) waste collection crews employed by the municipality of Laem Chabang, and 4) resident waste pickers who live on the dumpsite and process the trash dumped by the municipal crews.

The income generated from waste picking may be the only means of support for some participants in the informal waste sector, or may substantially enhance incomes earned through formal employment. The diversion of waste revenues from the informal sector into the formal sector would have profound consequences for individuals whose livelihood depends upon these resources.

No precise estimates are available as to the number of people in Laem Chabang who earn or supplement their incomes through waste recovery,

but some data is available to illustrate the importance of these revenues to those waste pickers who bridge the formal and informal waste economies—the municipal waste collection personnel.

Refuse collection vehicle in the municipality of Laem Chabang earn a monthly salary of \$3000 baht (CDN \$166.00.) Drivers report that they earn an average of \$500 baht per week, or \$2000 baht (CDN \$111.00) per month, through their waste recovery activities. Thus, their individual incomes are supplemented by 66.9% through waste recovery.

The municipality currently employs 11 vehicle drivers and 44 garbage collectors. These individuals are able to collect the largest proportion of high quality wastes due to their job duties, their exposure to "prime" residential and industrial wastes, and their access to specialized waste collection vehicles. Their activities thus account for the capture of the most lucrative and easily-obtained fraction of the commingled waste stream.

The question arises as to whether or not it would be financially advantageous for the formal waste collection sector (the municipality) to co-opt this collection process, using municipal personnel to sort trash and selling recoverables to generate operating revenue.

Assuming that the reported average earnings of \$2000 baht per month for each of the 55 municipal waste collection employees are accurate, this represents a potential revenue of \$1,143,000 baht (CDN \$79,444.00) per year, assuming (unrealistically) that the labour for sorting would continue to be provided at the same level by municipal employees, as part of their salaried duties. This would theoretically increase waste revenues by 6%, less expenses, or reduce the annual operating deficit

by almost 25%. At first glance, this might seem attractive to municipal policymakers.

**However:**

- The incomes of the waste collectors would drop by some 40%, making it difficult or impossible to earn a living in this occupation. As a result, the municipality would likely have to increase salaries in order to keep employees in these positions, eroding the financial benefits of the sale of recoverables;
- morale of employees would plummet if their employer interfered with their earning potential in this manner;
- efficiency and thoroughness of waste separation would drop, in the absence of an economic incentive to continue the activity;
- the efficiencies and market responsiveness, as well as the buffering effects of commodity storage by waste pickers and brokers, would be undermined or lost;
- additional administrative costs and overhead costs for storage and sorting facilities would be incurred by the municipality;
- itinerant waste pickers would be deprived of a self-sufficient livelihood, eliminating the opportunity for sub-sistence by one of the most stigmatized and marginalized levels of society, and increasing the likelihood that they will become a societal burden;
- the inherent economic efficiencies of low-cost labour for waste separation would be lost;
- in the event of a precipitous drop in the value of recoverables, the municipality would incur the loss for labour costs for separation of materials which may be rendered worthless by the vagaries of the volatile secondary materials market.

Thus, though the data presented is imperfect and incomplete, it suggests that the value of the services provided to the community by the informal sector likely outweigh the economic value of the materials they scavenge from the waste stream.

**Research Questions – 29 July 1994**

Information is required on the following aspects of the waste collection and management process in Laem Chabang:

1. **Stakeholders in the waste collection process-**
  - Functional description and numbers of individuals involved at each stage of the formal and informal waste management processes:
  - **residents/businesses** practising source separation for economic gain;
  - **roadside pickers** collecting recoverables from waste drums prior to collection by municipal crews;
  - **street sweepers** collecting waste from municipal streets and public places;
  - **municipal waste collection crews** collecting waste and sorting recoverables as part of daily duties;
  - **resident waste pickers at dumpsite** sorting through wastes remaining after municipal collection crews have processed it;
  - **locally active waste buyers and brokers** purchasing recoverables from all levels of the informal waste economy;
  - **industrial waste buyers and brokers** active in the industrial estates or other sources of industrial waste materials;
  - **hazardous waste collection agencies, and disposal routes.**
2. **Composition of solid waste, and daily per capita waste generation**



Requires data on:

- categories of waste generated, by weight and volume-> estimate proportional and absolute representation in the waste stream
- per capita waste generation-> need to be able to associate waste with individual households (or at least with a definable group of households), where population numbers are well known. Must group data sets by same general socio-economic category.

### 3. Economic value and diversion rates of recovered materials, at all stages in the waste collection process

-required to evaluate the efficiency of informal-sector waste recovery operations. Requires lifecycle data in the municipality on:

- type and quantity of each recoverable commodity;
- trends in the economic value of such commodities, including data on the stability of secondary materials markets as perceived from Laem Chabang;
- level in the informal hierarchy where waste diversion occurs, by material type, quantity, quality, and economic value.

### 4. Waste management policy in Laem Chabang: policies and practices in relation to national, provincial, municipal, and sanitary district levels

5. Organisational chart of the Municipality of Laem Chabang number of employees, names and titles, duties (focus on Environmental Health Division, but include other departments if appropriate).

### 6. Relative efficiencies of vehicles at waste collection-

must compare fuel use and personnel time spent in collecting wastes on a unit volume or unit weight basis. Requires data on:

- waste volume (weight) per truck, by truck type;
- fuel efficiency of different vehicle types;
- odometer readings of trucks at key points;
- nature and trajectory of route (municipal, commercial, industrial)

### 7. Prospects for composting in Laem Chabang

-need data on:

- existing composting operations or pilot projects elsewhere in Thailand (e.g., Bangkok-contact authorities, and arrange for interviews and copies of research publications);
- agricultural activities in Laem Chabang (existing or potential);
- extent and title of land ownership at dumpsite (for installation of composting facility, or possible revenue-generating onsite municipal operation);
- market data for finished compost in Eastern Seaboard region (farms, gardens, private residences, parks, roadsides etc.)

