A STUDY ON MUNICIPAL SOLID WASTE MANAGEMENT IN SARAWAK

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ABSTRACT

Waste has become the main by-products of everyday living in Sarawak. Waste generation and composition are strongly related to the regional socio-economic conditions and also the amount of population in every district in Sarawak. Socio-economic factors that enable an increase in the standards of living of the regional economy will influence the per capita rate of waste generation and the composition of waste generated. The per capita waste generation may generally increase concurrently with increased standards of living. According to a Natural Resources and Environmental Board (NREB) research, the total amount of solid waste generated that a single person generated a day is estimated an average of 0.67 kg of waste a day in Sarawak. Kuching is the most densely populated district in Sarawak and estimated to grow at a steady rate approximately 2% per year. Municipal Solid Waste management in Kuching District is primarily the responsibility of the local authorities (LA). Dewan Bandaraya Kuching Utara (DBKU), Majlis Bandaraya Kuching Sealatan (MBKS) and Majlis Perbandaran Padawan (MPP) responsible in the study of solid waste for their administrative area while Trienekens Sdn. Bhd is the private sector that responsible for disposing, studying and collecting solid waste in Kuching. Results from the increase volume of solid waste in Kuching, the local authorities have conducted a sanitary landfill system as a solid waste disposal.The legal facility that is available for disposal of solid waste within the Kuching city boundaries is the Matang dump site and Kuching Integrated Waste Management Park at Mambong. From the data acquisition, an alternative design of sanitary landfill will be produced. All the data are collected from Trienekens Sdn. Bhd, DBKU, MBKS, MPP, NREB and DOS. The data required for alternative design of a sanitary landfill are population of people in Kuching, propose design life of a landfill, total municipal solid waste generated in Kuching and amount of municipal solid waste generated by a single person per day.

ABSTRAK

Sisa pepejal merupakan produk utama yang dihasilkan oleh setiap individu yang menetap di Sarawak. Peningkatan jumlah sisa pepejal dan juga komposisi sisa pepejal di Sarawak adalah berkait rapat dengan keadaan sosio-ekonomi dan juga jumlah populasi di setiap daerah. Keadaan sosio-ekonomi yang mampu meningkatkan taraf hidup akan mempengaruhi penghasilan sisa pepejal setiap hari. Dari hasil kajian oleh Natural Resources and Environmental Board , jumlah sisa pepejal yang dihasilkan oleh setiap individu di Sarawak ialah 0.67 kg setiap hari. Dianggarkan bahawa, populasi di daerah Kuching merupakan yang paling padat berbanding dengan daerah-daerah lain dan dianggarkan meningkat 2% setiap tahun. Pihak berkuasa tempatan merupakan pihak yang bertanggungjawab terhadap pengurusan sisa pepejal di Kuching. Dewan Bandaraya Kuching Utara (DBKU), Majlis Bandaraya Kuching Sealatan (MBKS) and Majlis Perbandaran Padawan (MPP) merupakan pihak yang bertanggungjawab terhadap melakukan kajian terhadap sisa pepejal di kawasan yang telah ditetapkan manakala Trienekens Sdn. Bhd. merupakan pihak swasta yang mengendalikan pelupusan, kajian dan juga pengumpulan sisa pepejal di Kuching. Dengan peningkatan jumlah sisa pepejal di Kuching, pihak berkuasa tempatan telah melakukan kaedah sistem kambusan tanah untuk pelupusan sisa pepejal di tapak pembuangan sampah. Tempat pelupusan sampah yang sedia ada di Kuching adalah tapak pelupusan sampah di Matang dan “Kuching Integrated Waste Management Park” yang baru siap dibina di Mambong. Hasil daripada pengumpulan data, satu rekabentuk bagi kaedah kambusan tanah akan dihasilkan sebagai rekabentuk alternatif. Semua data adalah diperolehi daripada pihak Trienekens Sdn. Bhd, DBKU, MBKS, MPP, NREB and DOS. Data yang dikehendaki untuk melaksanakan satu rekabentuk alternatif untuk kaedah kambusan tanah ialah populasi penduduk di daerah Kuching, jumlah keseluruhan sisa pepejal yang terhasil di daerah Kuching dan juga jumlah sisa pepejal yang dihasilkan oleh seorang individu dalam sehari.

CHAPTER 1
INTRODUCTION

1.1 Solid Waste Management

Management can be defined as the judicious use of means to achieve an end. Solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes. In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in solutions to all problems of solid such fields as political science, city and regional planning, geography, economics, public health, sociology, demography, communications, and conservation, as well as engineering and materials science

In society that is producing ever increasing amounts of solid waste, the identification of appropriate methods of waste management become increasingly important. The disposition or re-use of solid waste materials can offer a variety issues, the environmental and social impacts of the waste management must be considered when designing socially optimal waste management strategies.

The waste management process has a number of stages. The volume and toxicity of ways can be reduced at source through more effective design, manufacture and packaging of products. Waste volume can also be reduced through recycling and waste transformation, where material is converted either into other product or into energy via combustion or collection of combustible biogas. Any remaining material must be disposed of in landfill sites.

Integrated Solid Waste Management systems attempt to manage society's waste in a way that meets public health issues, while at the same time operating within budgetary constraints and satisfying a growing body of regulation.

From economic perspective, optimal solid waste management systems would be those that ensure that society gains the maximum benefit from the disposal of its waste. Key health and safety objectives must always be met by any waste management strategy; however, alternative approaches may be available that satisfy these objectives. Once these key objectives have been met, the choice of management strategy should be determined by maximizing the ratio of societal benefits to management costs. Thus management strategies may need to address to public concerns about the externalities that surround waste management and the need for the sustainable use of resources.

Options which, at the same time as satisfying legal requirements, minimize the impact on landscape produce least disruption (i.e. noise, litter and odour) and support sustainable resource use may maximize benefits. Such options may also involve the greatest coats. The determination of strategies that provide the highest net benefits to society should ensure optimal waste management.

1.2 Solid Waste Disposal System

Disposal completes the solid waste management chronological cycle. Sometimes a type of physical processing or salvaging may precede disposal, but in the majority of cases, refuse is disposed of directly.

There are two basic methods of disposal: sanitary landfilling and incineration. However, only landfilling is a complete and final means. Incineration perhaps more properly termed a waste volume reduction technique, for regardless of the operational efficiency of any

incinerator, total combustion can never be achieved and some residue will remain requiring disposal.

Composting is a process which has been used to dispose of the organic portion of solid waste, but it has proven to be economical.

In Sarawak, the common and widely used method for solid waste disposal is landfilling. This is because, landfilling stands alone as the only waste disposal method that can deal with all materials and in Sarawak , there are many kinds of solid waste that are produce due to large population. Landfilling is also considered the simplest and in many areas the cheapest, of disposal methods.

At presents, the MBKS and DBKU municipal solid wastes are being dumped onto Matang Dumping Site while Natural Resources and Environmental Board Sarawak (NREB) is a sector that carry out monitoring and enforcement at all site projects. According to NREB, there are 45 existing dumping grounds in Sarawak and a total of 40 (approx. 75% of total) throughout the 9 divisions were visited by the NREB. The total area designated for dumping of municipal solid waste (MSW) is about 200 acres (or 80 Hectares) and about 370,000 metric tonnes of solid wastes are disposed at these dump sites annually. Based on the study conducted, it is estimated that a single person generates an average of 0.67 kg of waste a day in Sarawak. Based on this estimation, Sarawak with a population of approximately 2 million will generates around 511,000 metric tonnes annually. Thus, it can be clearly seen that only about 72% of solid waste generated are collected and the rest are disposed into river, buried in backyard, burned etc. as they are either not covered by the collection route or disposed illegally.

Trienekens (Sarawak) Sdn. Bhd. Is a private sector that responsible for management of municipal solid waste in Kuching, Sarawak. Trienekens (Sarawak) Sdn Bhd was

incorporated on the 8 June 1999 as the operating company and company appointed by Sarawak Wastes Management Sdn. Bhd. to develop, implement and operate the Integrated Solid Wastes Management System (ISWMS) in Sarawak.

Kuching Integrated Waste Management Park situated at Mambong is the first integrated waste management and disposal facility of highest international standard in the South East Asia region, this park will contribute significantly towards the elevation of the people's standard of living and attracting foreign investments into the State.

The facility was designed and planned by Trienekens' team of engineers. Applying the experiences garnered from similar projects in other parts of the world and taking into account the specific conditions in Sarawak, a unique customized concept was developed to suit the requirements and conditions from environmental standards to climatic impact.

Built to international standards and in full compliance with the environmental protection regulations outlined by the Department of Environment and the respective local environmental agencies, as well as Trienekens own standards for a safe, environmentally friendly and professional operation, the state-of-the-art waste disposal park incorporates the following features; sanitary landfill for municipal solid wastes, secure landfill for scheduled and hazardous wastes, hazardous wastes incinerator and all necessary auxiliary facilities.

1.3 Objective

Nowadays, people all over the world are concerned about pollution that happens everywhere. Extra efforts and serious actions to protect this world from being polluted or least to reduce the potential of pollution have been taken. Several regulations and acts had been set up to support the effort. The objective of this project is to collect data and analysis on municipal solid waste in Kuching, Sarawak and to learn more about the management and design on Matang landfill and Kuching Integrated Waste Management Park at Mambong. From the data and information that had been collected, an alternative design of a sanitary landfill as a municipal solid waste disposal system will be evaluated.

CHAPTER 2

LITERATURE REVIEW

2.1 DEFINITION OF SOLID WASTE

Solid waste is any unwanted solid material that is no more needed and rejected by the society. They are said to have negative economic value which suggests that they are not worth the cost and effort involved in recycling and are cheaper to throw away than to recover

2.1.1 Sources of Solid Wastes

According to Tchobanoglous et al. (1993), knowledge of the sources and types of solid wastes, along with data on the composition and rates of generation, is basic to the design and operation of the functional elements associated with the management of solid wastes.

Sources of solid wastes in a community are, in general, related to land use and zoning. Although any number of source classifications can be developed, the following categories are useful:

- Residential
- Commercial and Institutional
- Construction and Demolition
- Municipal services
- Treatment plant sites
- Industrial and Agricultural

Typical waste generation facilities, activities or locations associated with each of these sources are reported in Table 2.1

Table 2.1 Sources of solid wastes within a community (Tchobanoglous et al. 1993)

Source	**Typical facilities, activities, or locations where wastes are generated**	**Types of solid wastes**
Residential	Single family and multifamily detached dwellings, low-, medium-, and high rise apartments, etc.	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, tin cans, aluminum, other metals, ashes, street leaves, special wastes (including bulky items, consumer electronics, white goods, yard wastes collected separately, batteries, oil and tires), household hazardous wastes
Commercial	Stores, restaurants, markets, office buildings, hotels, motels, print shops, service stations, auto repair shops, etc.	Paper, cardboard, plastics, wood, food waste, glass, metals, special wastes (see above), hazardous wastes, etc.
Institutional	Schools, hospitals, prisons,	As above in commercial
Construction and demolition	New construction sites, razing of buildings, broken pavement	Wood, steel, concrete, dirt, etc.
Municipal services (excluding treatment facilities)	Street cleaning, landscaping, catch basin cleaning, parks and beaches, other recreational areas	Special wastes, rubbish, street sweepings, landscape and tree trimmings, catch basin debris, general wastes from parks, beaches, and recreational areas
Treatment plant sites; municipal incinerators	Water, wastewater, industrial treatment processes, etc.	Treatment plant wastes, principally composed of residual sludge
Municipal solid waste	All the above	All the above
Industrial	Construction, fabrication, light and heavy manufacturing, chemical plants, etc.	Industrial process wastes, scrap materials, etc. Non-industrial wastes including food wastes, rubbish, ashes, demolition and construction wastes, special wastes, hazardous wastes
Agricultural	Field and row crops, orchards, dairies, farms, etc.	Spoiled food wastes, agricultural wastes, rubbish, hazardous wastes

In this project, only *municipal solid waste* (MSW) will be discussed since it is the source that produces the most solid waste in this country.

2.1.2 Types of Solid Waste

According to Rimberg (1975), municipal solid waste is generally classified into six categories. These six categories are food wastes, rubbish, ashes and residues, demolition and construction wastes, special wastes and treatment plant wastes. The descriptions of these wastes are given the Table 2.2.

Table 2.2 Classification of Municipal Solid Waste (Rimberg, 1975).

Component	Description of waste
Food wastes	The animal, fruit, or vegetable residues (also called garbage) result from the handling, preparation, cooking and eating of foods. Because food wastes are putrescible, they will decompose rapidly, especially in warm weather.
Rubbish	Rubbish is any combustible and non-combustible solid wastes, excluding food wastes or other putrescible materials. Typically combustible rubbish consists of materials such as paper, cardboard, plastics, textiles, rubber, leather, wood, furniture, and garden trimmings. Non-combustible rubbish consists of items such as glass, crockery, tin cans, ferrous and non-ferrous metals, dirt, and construction wastes.
Ashes and residues	Materials remaining from the burning of wood, coal, coke and other combustible wastes are called ashes and residues. Residues from power plants normally composed of fine, powdery materials, cinders, clinkers and small amounts of burned and partially burned materials.
Demolition and construction wastes	Wastes from razed buildings and other structures are classified as demolition wastes. Wastes from the construction, remodeling, and repairing of residential, commercial, and industrial buildings and similar structures are classified as construction wastes. These wastes may include dirt, stones, concrete, bricks, plaster, lumber, shingles, plumbing, heating, and electrical parts.
Special wastes	Wastes such as street sweepings, roadside litter, catch basin debris, dead animals, and abandoned vehicles are classified as special wastes.
Treatment plant wastes	The solid and semisolid wastes from water, wastewater, and industrial-waste treatment facilities are included in this classification.

2.1.3 Municipal Solid Wastes (MSW)

The term Municipal Solid Waste (MSW) is generally used to describe most of the non-hazardous solid waste from city, town or village that requires a routine or a periodic collection and transport to a processing or disposal site. Sources of MSW include private homes, commercial establishments and institutions such as schools, as well as industrial facilities. However, MSW does not include industrial process wastes, construction and demolition debris, sewage sludge, mining wastes or agricultural wastes.

MSW comprises two types of materials: refuse and thrash. Refuse includes garbage and rubbish. Garbage contains putrescible or highly decomposable food waste, such as vegetable and meat scraps. Rubbish contains mostly dry, non-putrescible material, such as glass, rubber, metal cans, and slowly decomposable or combustible material such as paper, textiles or wood objects. Actually, less than 10 percent of refuse is garbage; most of it is rubbish. Thrash includes bulky waste materials that are generally require special handling and is therefore not collected on a routine basis. An old mattress, television or refrigerator is examples of thrash items (Nathanson, 1997).

2.1.4 Sources of Municipal Solid Waste

Tchobanoglous et al. (1993) categorized general sources of municipal solid wastes as follows (Refer to Table 2.3):