Chapter 4
Items of Consideration in the Design of a Malaysian Landfill

Mohamad Razip Selamat
Universiti Sains Malaysia, Malaysia

Hamidi Abdul Aziz
Universiti Sains Malaysia, Malaysia

ABSTRACT

The rate of waste generation in Malaysia continues to rise and this trend has created a pressure on landfills to perform in terms of capacity and quality. This scenario is not unique to the country alone but probably shared by many in the developing world. On one hand newly designed projects are initiated while on the other the old ones are still operating as open dumps. As in most cases with municipalities, a new site is not readily available for the new initiative, thus the existing facility has to accommodate both the newly designed landfill and the existing dump. In most cases also, due to lack of space and economical reasons, the two facilities have to eventually connect with each other and form a single facility. Thus this chapter is not only about designing a new provision but also about amalgamating the new one with the old one. In the design, the new one would require items such as leachate collection and treatment facilities while the old one would necessitate proper cover and drainage.

INTRODUCTION

Solid Waste in Malaysia

Municipal solid waste (MSW) has been defined as to include garbage, refuse, and any unwanted solid material arising from human activities. Disposal of MSW continues to be a major environmental challenge in developing countries including Malaysia.

The rate of waste generation in this country continues to rise each year mainly because of the general and domestic development. The increase has been in line with population and economic growth. In 1998, the yearly waste generated was 6 million tons (0.5-0.8 kg per capita per day). In 2005 however,

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it has increased to 7.43 million tons (Agamuthu, 2006). By the year 2020, the quantity of solid waste generation per year is expected to top 30 million tons (Manaf et al., 2009). Such a tremendous increase is primarily due to the rapid urbanization, increase in population, improvement of per capita income, and changes in consumption patterns (Umar 2009).

Food waste, categorized as organic waste is an important constituent of the solid waste for its unique degradation properties. It represents 32% of the waste composition in Malaysia (Ridhuan, 1995). Typically, an MSW sent to landfill is comprised of food, garden refuse, paper products, plastics, rubber, textiles, woods, and ashes.

Use of Landfills

A landfill allows disposal of large quantities of MSW at an economical cost. Thus MSW disposal by land-filling continues to be the most commonly used method worldwide. In Malaysia, MSW has been disposed off in landfills though some of these facilities have not been properly presented and were simply of open dump category.

The continued used of landfill disposal method is commonly due to convenience. For as long as the adverse environmental effects is tolerated, or mitigated, the use of landfills will eventually transform all waste into relatively inert and stabilized materials (Robinson & Maris, 1983; Williams, 2005). Basically, there are no combinations of waste management practices that do not require landfills. Even in incineration process, there will be waste eventually to be disposed off in a landfill.

The foremost challenge in running a landfill is in ensuring that all operating facilities are designed properly and are monitored not only during operation but also after closure.

Landfill Closure

Designing a sufficient final cover is crucial in ensuring a proper landfill closure (Bagchi, 2004). The final cover is as significant as the liner system that is placed at the base of a landfill early in the preparation. However, the final cover becomes even more important when a liner system has not been used for the base which is common for many of the open dumps that are currently operating in the country. In the Malaysian practice, an open dump is normally closed by having simply about 1 m thick of laterite soil laid over the entire dump area.

Principally, a final cover is applied when a landfill reaches maximum volume capacity in order to minimize rainfall infiltration, reduce leachate generation, and avoid possible environmental contamination. Elshorbagy and Mohamed (2000) define that the covering system of a landfill should involve partial or complete isolation of waste materials from the surrounding environment. Many would agree that the main aim of having a landfill final cover is to decrease or eliminate transport of liquids through the waste. In general, a good landfill final cover should effectively eliminate the generation of landfill leachate as typical landfill leachate contains a large amount of poisonous pollutants that can cause a severe hazard to the surrounding ecosystem (Aziz et al., 2010 (a&b); Bashir et al., 2010).

Generally, the criteria for a sound landfill closure focus on the establishment of a low cost maintenance cover system and on the minimization of infiltration from precipitation. Some of the technical issues that must be addressed by a landfill designer are the changes that will take place with the surface cover barriers such as settlement and damage. A landfill cover simply must be durable in the long term (Murphy & Garwell, 1998). The final cover system should have at least 450 mm of suitable soil for protection