CHAPTER 5
WASTE DISPOSAL

INTRODUCTION

Population growth and industrialisation have brought about waste disposal problems that pose a tremendous challenge to the planners and managers of Kuala Lumpur. In the pursuit of a prosperous economic base over a relatively short period of time, tradeoffs had to be made in the provision of urban services. In the case of Kuala Lumpur, there has been relatively more emphasis on the provision of urban services such as piped water supply, electricity, drains, paved roads and other forms of infrastructure and support essential for health. Large investments in these form of urban services were at the expense of proper provision of sanitation and garbage disposal.

The result of this neglect is now becoming more apparent in Kuala Lumpur and cannot be ignored without compromising the environment and public health, which would then undermine the prosperity attained thus far. With the advent of industrialisation, new environmental problems have also emerged, in the form of toxic and hazardous waste, demanding immediate attention and containment measures. Thus, it is not surprising that a primary concern in Kuala Lumpur is the management and disposal of an increasing amount of waste which contribute to environmental degradation in the city. These wastes include municipal solid waste generated by domestic, commercial and industrial sources, municipal sewerage as well as toxic and hazardous wastes.

MUNICIPAL SOLID WASTE

Municipal solid waste is defined as combined domestic, commercial and institutional wastes generated in a given municipality or locality but does not include scheduled wastes generated by manufacturing enterprises (DOE 1995a). Notwithstanding this, municipal wastes do contain quantities of certain scheduled wastes arising from residential premises, offices and public buildings.

Solid Waste Generation

Kuala Lumpur prospered with the advent of direct foreign investment into the country in the 1970's. This is reflected in the economic growth and physical development of the city, which coupled with the deliberate urbanisation policy of that period, served to increased the population. As a result, the amount of waste that that was generated multiplied. Over a period of ten years,

from 1975 to 1985, there was an almost five fold increase in the amount of waste generated daily by the population of Kuala Lumpur (Table 5.1).

In the absence of systematic data collection, the Kuala Lumpur City Hall (DBKL) estimated that the population of Kuala Lumpur generated about 1,977 tonnes of waste daily in 1985. According to DBKL, the amount of waste generated increased to 2286 tonnes of waste daily in 1990, and 2619 tonnes per day in 1995 (Table 5.1). This is supported by a survey conducted by a local university in 1994, which estimated that 3020 tonnes of waste was generated daily in Kuala Lumpur (Nasir *et al*. 1995). However, another assessment (GOM 1996) placed the amount of waste generated about 60% lower than that estimated by DBKL, with a daily production of 766 tonnes in 1990 and 913 tonnes in 1995.

DBKL has projected that the amount of waste generated would increase to 3070 tonnes per day by the year 2000, and up to 3,478 tonnes per day in the year 2005. The projection made by the local university (Nasir *et al*. 1995) is about 20-30% higher in comparison, with the amount of waste generated daily anticipated to be in the region of 3796 tonnes for the year 2000 and 4618 tonnes for 2005. In contrast, another projection placed the amount about 70% lower than that of the DBKL estimate.

Industries generated the highest amount of waste in 1985, contributing 46% of the total amount of daily waste production. In comparison, only 29% of the total waste generated was from domestic sources while the commercial sector contributed 23% of the total waste. A similar scenario persisted in 1990 with the industrial, domestic and commercial sectors producing 40%, 33% and 24% respectively, of the total tonnage of daily waste generated. However, in 1995 there was a change in the status quo. The domestic and industrial sources generated similar quantities of waste per day (about 36% from each sector) while the proportion of waste produced by the commercial sector remained the same (about 25%).

Since 1985, sustained economic growth for over a decade led to an increase in the affluence of the population in Kuala Lumpur. The outcome of such affluence was higher consumption, resulting in increased domestic waste generation over the same period. The domestic waste generated increased from 573 tonnes per day in 1985, representing 29% of the total waste, to 934 tonnes per day in 1995, representing 36 % of the total waste generated. It is projected that by the year 2000 and 2005, domestic sources would generate the highest proportion of municipal waste, representing 39% and 41% respectively, of the total waste generated.

Solid Waste Constituents

The type of waste generated in Kuala Lumpur has become more complex with increased affluence and consumerism over the decades. The constituents of solid waste generated in 1975, 1986 and 1994 are categorised into organics (which include food waste, wood etc.), paper, plastic, metal and others in Table 5.2.

Table 5.1: Estimated Daily Waste Generation in Kuala Lumpur.

Year	Domestic Waste (tonne/day)	Commercial Waste (tonne/day)	Industrial Waste (tonne/day)	Uncollected Waste (tonne/day)	Total Quantity (tonne/day)
1971	-	-	-	-	150
1975	-	-	-	-	400
1985	573	459	900	45	1,977
1990	750	552	925	59	2,286 (766)*
1994	(1010)#	(850)#	(1160)#	-	(3020)#
1995	934	662	950	73	2,619 (913)*
2000	1,185	817	975	84	3,070 (3,796)# (1,022)*
2005	1,419	947	1000	112	3,478 (4618)# (1,058)*

Figures in bracket marked as ( )* are from GOM (1996) while those marked as ( )# are from Nasir *et al*. 1995. Source: DBKL (1994, 1992).

Table 5.2 shows that the organics category comprises up to 72% of the total solid waste generated in Kuala Lumpur in 1975. The balance is made up of paper, cardboard, plastic, metal

and other constituents. It is observed that the amount of organics in the solid waste generated in 1986 dropped by 15% to 57% compared to 1975. A further drop of 9% in the organics category occurred by 1994.

Corresponding to the drop in the organics category, the amount of material that was generated in the paper and plastic categories increased by 18% and 3% respectively, from 1975 to 1994. This can be attributed to increased consumerism resulting in greater use of wrapping and packaging material. The greater volume of non-biodegradable material, especially plastics, in the waste will cause serious problems in the future and corrective measures need to be taken immediately.

On a positive note, it is observed that the amount of metal constituent in the waste generated has dropped in 1994 compared to 1975 and 1986. This is most likely due to the high market price for recycled metal, which is three times higher than paper or glass, per equivalent weight (Nasir *et al*. 1995). Thus, relatively more metal is recycled compared to paper or glass, resulting in their reduced proportion in the waste generated.

Solid Waste Collection

The services provided by DBKL pertaining to solid waste include waste collection and disposal as well as maintenance of the cleanliness of streets and drains (DBKL 1990). The total amount spent on these services has doubled over the past decade (Table 5.3). About 60% of the total amount used up over the years is for solid waste collection and disposal. Nearly 90% of this is spent on collecting the waste from different sections of the city and transporting it to the waste disposal site.

Table 5.2: The Constituents of Solid Waste Generated in 1986 and 1994 from the Kuala Lumpur area.

Category	1975	1986 Constituents	1994 Constituents
Organics-Food Waste/Wood/etc.	71.5	57	48.4
Paper	11.7	22	30
Plastic	7*	8*	9.8
Metal	6.4	6	4.6
Others	3.4	7	7.2

*Note: In the 1975 and 1986 studies, rubber was included in this category.
Source: GOM (1982, 1986) and Nasir *et al*. (1995).

Table 5.3: DBKL Funding for Cleanliness, Solid Waste Collection and Disposal

Year	Cleanliness (RM)	Waste Collection & Disposal (RM)	Total (RM)
1980	7,694,000	11,885,000	19,579,000
1985	16,502,000	19,085,000	35,587,000
1990	19,055,600	25,423,000	44,478,600
1994	26,747,500	42,934,400	69,681,900

Source: DBKL (1990, 1993 & 1994) and Ibrahim (1996).

DBKL collects solid waste from residential areas which include houses and apartments as well as from commercial areas which include shop houses, shopping complexes, hotels, markets, government complexes and other public buildings. Industrial areas are served by private contractors. A survey carried out by a local university indicates that 90% of the population of Kuala Lumpur receive waste collection facilities (Nasir *et al*. 1995). However, estimates indicate that 3% of the waste generated in Kuala Lumpur is uncollected (DBKL 1994). These are mainly from undeserved areas such as squatter settlements, new settlements and villages.

Residential areas are served four times a week while commercial areas are served on a daily

basis. While collection and on-site storage is generally adequate in housing estates, studies indicate that apartments and commercial areas tend to have improper and insufficient storage bins (GOM 1987; Nasir *et al*. 1995). This often results in spillage, despite the fact that collection is regular, and reduces the overall efficiency of the services provided by DBKL.

Another issue that has been highlighted is the labour intensive nature of the collection services provided. This is compounded by the high turnover of human resources. As a result, the reliability of collection schedules has, to a certain extent, been compromised (Nasir *et al*. 1995; Ibrahim 1996). In addition, the long haulage distance and the high cost of maintaining collection vehicles has limited the capacity of DBKL to expand and intensify its collection services (Ibrahim 1996).

Since 1988, DBKL has also been responsible for keeping the rivers and canals in the city free from rubbish (DBKL 1991). The main rivers that flow through Kuala Lumpur are *Sungai Klang*, *Sungai Gombak* and *Sungai Batu* (Figure 5.1). In 1988, a short term programme was initiated to clean and improve the physical condition of the main rivers in the city centre. A total of RM 18,678,116 was spent over a period of six years for construction of rubbish and silt traps as well as removal of silt (DBKL 1991). Under this programme, 14 floating rubbish traps were placed across the rivers at strategic points while silt traps were constructed at *Sungai Gombak*, *Sungai Keroh*, *Sungai Bunus* and *Sungai Batu* to reduce river siltation in the centre of the city.

Solid Waste Disposal

DBKL operated three dumping sites up to 1995 but only one is still operating (Table 5.4). The open dumping method of disposal is practised, whereby the waste is levelled, compressed and covered by soil and sand. A study carried out in 1986 recommended many improvements in the management of solid waste disposal sites in the Klang Valley (GOM 1987). These included taking measures to control access to sites and scavenging activities, reducing odour, improving vector control, terminating open burning on the site, eliminating wind-blown debris, practising daily covering of waste and control of gas migration.

Since then, some of the recommendations made have been implemented. Several measures were taken by DBKL as part of its dump-site management. These include spraying chemicals for vector and odour control, provision and maintenance of troughs to clean the tyres of haulage vehicles and planting of trees and grass to prevent erosion and act as a barrier (Ibrahim 1996). Although gas venting was noted to be practised in the dump-site of Kuala Lumpur, no treatment of leachate was observed (Nasir *et al*. 1995).

Many problems persist in the waste disposal site of Kuala Lumpur, not unlike those in other parts of Malaysia. Scavenging is a major problem at the Jinjang site, the sole operating dump-site in Kuala Lumpur. There are about 80 scavengers at the site, earning RM 20-60 per day selling recyclable items (NST 1997). Some of them reportedly work up to 20 hours a day. Furthermore, the presence of squatter houses and small factories adjacent to the dump-site is another problematic issue that DBKL has to contend with. The occupants of these premises are exposed to health hazards due to their proximity to the site.

The encroachment of housing and industrial estates on to previously idle land is threatening the future operations of the dump-site in Kuala Lumpur. Added to this is the problem of land acquisition for siting new sanitary landfill operations. As a result, Kuala Lumpur is fast running out of space to dispose of its waste. To address this problem, long-term solutions were sought for waste disposal. Among the options considered were composting and incineration.

Composting was an attractive option with easily available technology and the production of useful material. However, it was found to be unsuitable during the late 1980's because of insufficient market for the product in Malaysia (GOM 1987). The capital cost for an incinerator was found to be too high, about six times higher than that of a sanitary landfill. Furthermore, the burning of wastes with significant amount of plastics would cause serious equipment corrosion, apart from the exposed emission of gases such as dioxin and furan.

It was concluded that irrespective of whether an incinerator is built in the Klang Valley, a regional waste disposal system based on sanitary landfill remains the most cost-effective method for disposing solid waste. The social cost for landfill, which includes the direct cost as well as the cost of environmental damage, is estimated to be about RM 35 for each tonne of waste. The social cost for an incinerator is 15 times higher compared to a landfill, about RM 500 per tonne of waste. In the case of composting, the cost is RM 216 per tonne of waste, about six times higher compared to a landfill (Nasir 1992).

Table 5.4: Selected features of solid waste disposal sites in Kuala Lumpur.

Features/Locality	Sri Petaling	Jinjang North	Sungai Besi
Area	21.6 ha	12.0 ha	8.1 ha
Commencement	1975	1979	1989
Status	Closed	Operating	Closed
Type of Waste	-	Domestic, garden and construction material	Domestic, garden and construction material
Quantity Disposed	-	1000 t/day	1200 t/day
Cover Material	-	Sand (500 t/day)	Sand (500 t/day)
Distance from Housing	-	500 m	600 m
Distance from City Centre	-	20 km	10 km
No. of Workers	-	8	10
No. of Bulldozers	-	5	5

Source: Ibrahim 1996

Environmental Consequences

The main environmental problem in Kuala Lumpur with respect to waste disposal is the open dumping that has been practised over the years, which is still prevalent today. The dump-sites do not have proper measures to control rainfall and run-off. As a result, large quantities of leachate are formed which pass downwards to pollute the groundwater. DBKL does not collect or accept industrial toxic waste at their dump-site. However, no measures are taken at the dump-site to separate out toxic waste from domestic and commercial sources. Examples of such wastes are batteries, paint solvents, pesticides, cleaning compounds, expired medicine and other products with heavy metal substances. This situation is compounded further by the absence of leachate containment and treatment. The impact of groundwater pollution on the health of the near-by residents is largely unknown.

The access to the dump-site is not properly controlled and this has encouraged indiscriminate scavenging operations. The scavengers are not only exposed to health problems but safety hazards as well. The bulldozers at the dump-site operate at a frantic speed to level the rubbish. In a recent incident involving the bulldozer, a scavenger lost a leg (NST 1997). Both the

haulage vehicle access and the dump-site are presently located near residential areas, making noise a nuisance that has to be borne. In addition, the odour and wind blown debris make living conditions unpleasant in this area. Although insecticide is prayed to cover soil and exposed waste, the spread of vector borne diseases is still a threat that cannot be ignored.

Even though the dump-site in Kuala Lumpur has not been carrying out open burning on-site, there are other dump-sites in the Klang Valley that have been reported to do so. In addition, the lack of gas venting has potential to cause serious fires at dump-sites. An example is the Hulu Langat dump-site in the Klang Valley, to the south-east of Kuala Lumpur, which was on fire for over three days (NST 1998a). Open burning is also common in underserved areas such as the squatter settlements, villages and other small settlements. The burning of waste contributes to atmospheric pollution. It is estimated that open burning contributes a pollution load in the region of 300 tons per day in the Klang Valley (GOM 1987).

Squatter settlements located along rivers are also a source of river pollution in Kuala Lumpur (Figure 5.1). The waste generated from squatter areas amount to about 200 tonnes per day (Ibrahim 1996). As squatter areas are generally underserved, only half of this amount is collected each day from central collection points (Noordin 1996). Indiscriminate littering is the norm in these areas. A significant proportion of the waste is discarded into rivers, costing DBKL millions of *ringgit* to clean-up.

In the early 1980's, several former mining pits in the Klang Valley were utilised for disposing solid waste. These areas have since been reclaimed for housing development. Unfortunately, many geotechnical problems were encountered during construction over such areas because of subsidence due to consolidation of the solid waste beneath this site (Tan 1986). As a result of improper reclamation, many buildings were defective, and in extreme cases, such buildings had to be demolished as they posed a serious hazard to its occupants.

MUNICIPAL SEWAGE

Municipal sewage refers to any liquid waste or wastewater discharge containing human, animal or vegetable matter in suspension or solution, and includes liquid containing chemicals in solution arising from residences, business buildings, institutions and industrial establishment (DOE 1995a). However, municipal sewage does not include untreated industrial effluents.

Evolution of Sewerage Services

When Kuala Lumpur was first established, there was no sewerage system and simple toilets were

used to dispose of untreated sewage. Simple toilets caused the outbreak of diseases during that period. Examples of such toilets include overhanging toilets, drain discharge latrines, pit latrines and bucket latrines (Indah Water 1997a, 1997b). Overhanging toilets discharged human excreta directly into the river while drain discharge latrines utilised pipes to channel untreated sewage into rivers. Pit latrines allowed the liquid to soak into the ground, leaving the solid material to slowly degrade. Sewage from bucket latrines was removed manually and carted to a treatment plant.

Flush toilets were introduced to Kuala Lumpur only in the 1950's (Indah Water 1997b). By the end of this decade, almost 16% of the population enjoyed this mode of sanitation (DBKL 1988). In certain areas, sewerage pipes leading to a central treatment plant, albeit with the limited technology of that period, was installed. However, a majority of the areas which possessed flush toilet facilities had sewage channelled to septic tanks, constructed in individual compounds. The septic tank is an unconnected sewerage system requiring regular desludging to operate efficiently. The system provides very limited treatment and the effluent that is discharged into drains and rivers contain high levels of organic pollutants.

Recognising the need to improve and modernise the sewerage facilities, DBKL formulated a long-term plan in 1975, referred to as the Kuala Lumpur Sewerage Master Plan, to install connected sewerage systems for the entire city (DBKL 1988). Connected sewerage systems generally consists of a network of underground sewer pipes, pump stations, sewage treatment plants and sludge treatment facilities. Well designed and carefully maintained sewerage systems can arrest the discharge of raw sewage and keep the rivers free from pollution.

Kuala Lumpur Sewerage Master Plan

The Kuala Lumpur Sewerage Master Plan was initiated in 1976 and the cost of implementing the master plan was estimated at RM 690 million (DBKL 1988). The master plan was designed to be implemented in 5 phases, over a period of 30 years from 1976 to 2005. The first phase of its development was completed in 1984 with a loan of RM 150 million from the Federal Government and the World Bank (DBKL 1993). The first phase involved the building of a central sewerage system based on four oxidation ponds and the laying of 129.2 km of sewers (Ibrahim 1996). The second phase of this project, which would about cost RM 440 million and provide centralised sewerage facilities for 3,000,000 residents, was postponed due to lack of funding.

In 1985, DBKL revised its strategy and focused on a Phase 1 Consolidation Programme (DBKL 1988). The aim of the consolidation programme was to optimise the use of the central

sewerage system that was set-up under Phase 1 of the Kuala Lumpur Sewerage Master Plan. DBKL spent a significant amount of its annual budget to maintain sewerage facilities and finance this programme.

Table 5.5: The Annual Budget for the Development and Operation of Sewerage Services in Kuala Lumpur from 1988-1993.

Year	Amount allocated for the development of sewerage facilities (million ringgit)	Amount allocated for the operations of sewerage and drainage facilities (million ringgit)
1988	13.1	27.5
1989	14.52	26.68
1990	15.98	29.27
1991	36.10	35.1
1992	47.29	37.74
1993	24.83	39.65

Note: The budget allocated for operations includes the maintenance of both the sewerage and drainage facilities. Source: DBKL Annual Report (1988, 1989, 1990, 1991,1992 &1993).

A total of RM 105 million was spent on the consolidation programme from 1985 up to 1993 (DBKL 1993). The annual investment for development and operation of sewerage services in Kuala Lumpur for five years, from 1988-1993 is shown in Table 5.5. Sewerage services provided by the DBKL encompassed desludging of septic tanks and treatment plants, planning and implementation of sewerage and drainage projects, construction of local treatment plants, and maintenance of sewerage, drainage and waste treatment plants.

Achievements of the Sewerage Master Plan

In the first two decades after the introduction of the flush toilet, less than 20% of the population in Kuala Lumpur had access to modern sanitation and there was only one regional sewage treatment plant in existence (Table 5.6 and 5.7). After the implementation of the first phase of the Kuala Lumpur Sewerage Master Plan, almost 70% of the population in Kuala Lumpur had access to modern sanitation.

In 1988, Kuala Lumpur was served by four regional sewage treatment plants, supported by

five pumping stations. Phase 1 of the Kuala Lumpur Sewerage Master Plan and its associated consolidation programme provided 45% of the housing, commercial and recreation areas in Kuala Lumpur with central sewerage facilities (DBKL 1989).

In conjunction with the implementation of the Kuala Lumpur Sewerage Master Plan, the private sector is required to provide local treatment plants in areas that are not connected to the centralised sewerage system (DBKL 1992). As a result of this requirement, more than 60 local treatment plants were constructed in new areas and their numbers continued to grow as the rate of development accelerated (Table 5.7). The local sewage treatment plants include communal septic tanks, Imhoff tanks and oxidation ponds. These local treatment plants would be eliminated in stages as the network of central sewerage facilities expand.

In 1989, the central and localised sewerage network extended over an area of 7,120 Ha, serving more than 70% of the residents in Kuala Lumpur (DBKL 1989). In 1992 80% of the population in Kuala Lumpur received modern sanitation facilities.

Table 5.6: Number and Percentage of the Population in Kuala Lumpur with Access to Modern Sanitation Facilities .

Year	Population in Kuala Lumpur	Population receiving modern sanitation facilities	Percentage receiving modern sanitation facilities
1958	320,000	50,000	15.6%
1974	780,000	150,000	19.2%
1988	1,300,000	920,000	70.2%
1989	1,340,000	960,000	72%
1990	1,400,000	1,050,000	75%
1991	1,420,000	1,107,600	78%
1992	1,430,000	1,165,000	80%

Source DBKL (1988, 1992).

Table 5.7: Sewerage Infrastructure Provided by DBKL in Kuala Lumpur.

	1974	1988	1989	1990	1991	1992
Number of Regional Treatment Plants	1	4	4	4	4	4
Number of Pumping Stations To Regional Sewage Treatment Plants	1	5	5	5	5	5
Length of Public Sewer Pipes (km)	130	347	483	495	536	552
Number of Local Sewage Treatment Plants	-	66	85	113	155	169
Number of Septic Tanks	30,000	26,000	25,000	22,240	20,000	18,000
Number of Simple Toilets	25,000	10,000	550	300	250	200

Source: DBKL (1992)

Environmental Consequences

Despite having spent a total amount of RM328 million ringgit on the development and operations of the first phase of the Kuala Lumpur Sewerage Master Plan and its consolidation programme (Indah Water 1997a), up to 20% of the Kuala Lumpur population has still not been provided with modern sanitation facilities. A total of 18,000 septic tanks and 200 simple toilets were still in use up to 1992 (Table 5.7). Compounded to this is the presence of about 40,000 squatter families and an unknown number of illegal immigrants (Ibrahim 1996). This group of people generally locate themselves by rivers and do not have access to basic amenities (Figure 5.1). As a result, human excreta is discharged directly into the rivers causing organic pollution.

DBKL also faced numerous problems due to limited funding and lack of technical expertise. Despite the increase in population, the number of regional sewage treatment plants remained the same from 1988 to 1992 (Table 5.6 and 5.7). The existing treatment plants cannot cope with the amount of sewage generated and as a result the excess untreated sewage is released directly into rivers (Ibrahim 1996).

Other prevalent problems include septic tanks that are not frequently desludged, lack of proper treatment for sludge and poorly-functioning or out-of-order public sewage treatment plants (Indah Water 1997a). In addition, many sewerage systems under the responsibility of private developers are not well maintained and some of the sewerage systems built by the developers are found to be not up to the required standards, due to lack of technical supervision by DBKL. These factors contribute to the release of untreated sewage into rivers.

The development of sewerage infrastructure has not been given the same priority as other basic improvements. In the past two decades, the government has invested RM 7.785 billion in developing clean water supply, more than 20 times the amount invested for sewerage infrastructure (Indah Water 1997a). The public have had to contend with the lack of proper, well maintained sewerage infrastructure, due to the limited financial and human resources of local authorities in Malaysia, including DBKL. As a result, the discharge of sewage has polluted the rivers in Kuala Lumpur and poses a serious threat to public health. It is for the purpose of accelerating investment on sewerage infrastructure and arresting this problem that sewerage services were privatised in Malaysia.

TOXIC AND HAZARDOUS WASTE

Toxic and hazardous wastes are defined as wastes or combination of wastes that pose a significant present or potential hazard to human health or living organisms (DOE 1995b). This definition specifically excludes municipal solid waste and municipal sewage. Toxic and hazardous wastes are broadly classified into the categories of chemical wastes, biological wastes, explosives and radioactive wastes.

The storage and disposal of toxic and hazardous waste which has been rising in quantity over the years are a growing national concern. In 1992, about 337,000 tonnes of toxic and hazardous waste were generated by the industries (GOM 1996). In the past industries have been storing their waste for up to several years. There have been several occurrences of illegal dumping of toxic and hazardous waste reported, due to the lack of facilities for their disposal.

In Kuala Lumpur toxic and hazardous waste is discharged from industrial activities related to metal finishing, electrical and electronics, textiles, food processing, chemicals, palm oil, rubber, wood as well as iron and steel manufacturing. Some of these industries are operating legally but a significant number are illegal operations. Data from a survey carried out indicates that there are about 120 illegal small-scale factories and enterprises in the northern part of Kuala Lumpur alone, around the Kepong and Batu Caves areas. About 50% of these illegal operations are related to iron and steel works, wood processing, food processing, textiles and rubber production, discharging an unknown amount of toxic and hazardous waste and contaminating the surrounding soils, water and groundwater (Table 5.8).

Table 5.8: Illegal Factories and Enterprises Around the Batu Caves and Kepong areas, in the northern part of Kuala Lumpur.

Industry	Number	Percentage
Services Industry (Grocery, Spare Parts, Restaurants etc.)	22	18
Iron and Steel Works	21	18
Wood and Wood Products	20	17
Food Processing	19	16
Car and Motorbike Workshops	19	16
Paper and Paper Products	6	5
Plastics and Fibre Glass	4	3
Textile	3	2
Glass and Glass Products	3	2
Rubber Products	1	1
Brickwork	1	1
Petrol Kiosk	1	1
TOTAL	120	100

Source: Gombak District Council (1993).

Figure 5.1: Sources of Sewage and Rubbish Pollution from Squatter Areas and Location of Waste Disposal Sites operated by DBKL (Modified after GOM 1987 and

DBKL 1992).